THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. X.—NO. 236.

THE ELECTRIC LIGHTING COMMITTEE.

THE Select Committee of the House of Commons for the consideration of the various measures promoted during the present session by gas companies, corporations, and electric lighting companies for the establishment of electric lighting, has given its decision, pending another meeting on June 8th, when any amendments, not contravening the principles of the resolutions arrived at, will be received and considered. We give the results of the committee's labours in another column. It will be seen that the Board of Trade will be empowered to grant licences to local authorities or to private individuals to supply electricity within a defined area, subject to the consent of the local authorities, or provisional orders may be granted for the same purpose without the consent of such authorities, subject to the sanction of Parliament.

The rules from 1 to 6 deal sufficiently fully with this matter, and we do not consider that much room is given for comment on these points, and it follows that rule 7 is a necessity to the proper carrying out of the work involved in permanent installations of the electric light. The next paragraph will doubtless be appreciated by both gas and electric light companies, on account of its absolute fairness to each party. In the Electric Lighting Bill recently brought before Parliament one of the clauses contained a regulation to the effect that, "Where any company or person is authorised by provisional order to supply electricity within any area, any local authority within whose jurisdiction such area or any part thereof is situated may, within *six months* after the expiration of a period of *seven years* from the date of the passing of the Act confirming such provisional order, and within six months after the expiration of every subsequent period of seven years, by notice in writing require such company or person to sell, and thereupon such company or person shall sell to them their undertaking, or so much of the same as is within such jurisdiction, upon terms of paying the then value, &c., &c." In our issue of April 22nd we made some remarks on this matter, and suggested that it would not be fair to any company supplying electric light to be compelled to sell their undertaking at the end of such a period, considering that the first two or three years might not be worked at a profit, but rather the reverse. We are glad to see that the number of years which may now elapse before the local authorities are empowered to purchase compulsorily such undertakings is extended to fifteen, or at the end of any subsequent period of five years. The conditions of purchase are also very fairly stated in rule 10, and it does not appear likely that such arrangements will be considered otherwise than equitable. "The regulations for (*a*) securing the safety of the public from danger to life, or from fire," demand more serious consideration than experience *may prove* to be necessary. We think that enough experience has already been gained in the first case to have enabled the committee to fix the limits of high tension currents within certain bounds, or is it essential that a few more lives shall be lost before general attention is drawn to the danger incurred by those engaged in looking after systems which employ as many as forty arc lights on one circuit? It is not to be expected that the companies using high tension electricity will admit that such danger exists, but they know it nevertheless, and as for ourselves, we shall not be surprised—be the precautions what they may—at hearing of deaths resulting from the employment of machines giving an electromotive force of 2,000 volt. In our last number we pointed out that the *indirect* risks of fire by the use of the electric light, apparently and unwisely are thought to form a more important element for consideration in the public interest than *direct* danger to life; and we do not yet find any reason to modify our ideas.

The remaining regulations for (*b*) inspection; (*c*) for securing a regular and efficient supply of electricity; (*d*) for fair prices—may be conveniently framed according to experience, especially as regards the two latter, for we have no reliable data to work upon respecting either one or the other. It only remains now for electric light companies or local authorities to commence work upon a large scale, so as to bring the labours of the Electric Lighting Committee into actual force. At present we have not a single installation of electric lighting of any particular value, and the only companies supplying electricity on even a moderate scale in London are those of Edison for lighting by incandescence, and Brush and Jablochkoff for arc lights. What may be done in the future, according to the opinions of the scientific witnesses examined by the committee, will be described in our other columns, and we may have occasion to say something on this subject in another number. The actual progress of the electric light does not appear to follow in proportion to the number of companies recently brought out; but this is hardly to be wondered at, considering the comparatively small number of really working concerns. In fact, since the Electric Lighting Bill was first mooted lighting by means of electricity has been almost at a standstill, although proposed installations, *if ever carried out*, are numerous enough. However, it is not right to be impatient in matters involving such stupendous operations, and if success does not follow so rapidly as could be wished, we have only to blame those too enthusiastic exponents of the "light of the future" for claiming somewhat prematurely that the "thing was done."

We may, however, congratulate all interested in electric lighting, that the subject has attained an importance which few of us would have believed two years ago would call for Parliamentary legislation so suddenly; a result which is due in the highest degree to the successful introduction of lighting by incandescence.

UNITED TELEPHONE COMPANY (LIMITED) *v.* ALEXANDER MACLEAN, EDINBURGH.—The reclaiming note against the judgment of the Lord-Ordinary (M'Laren) in this case came before the First Division of the Court of Session on the 18th ult., when it was intimated that Mr. Maclean was not to go on further with the action.

M. N. DE KABATH'S CORRUGATED ACCUMULATORS.

IT is now beyond doubt that the remarkable researches of M. Gaston Planté formed the starting-point of all the experiments undertaken during the last year or so for the purpose of adapting his invention to industrial applications. To tell the truth, the principles so clearly laid down in his "Researches on Electricity" have not been departed from for one moment, and for more than twenty years lead oxydised and reduced has formed the basis of all the accumulators of any power and practical value. It is on these scientific principles that the accumulators which we are now going to describe have been constructed; but in these types the object has been to impart to them the industrial qualities wanting in M. Planté's accumulators, and it is on this ground that we call attention to them.

Until now the accumulators of M. Planté have been constructed on a small scale, their weight not exceeding 5 kilogrammes, a weight totally inadequate for the storage of enormous quantities of electricity. This has led to types of 8, 10, 15, 20, 40, and 60 kilogrammes being constructed successively. The limit in this respect has not, however, been reached, and in considerable installations, in which the electrical reservoirs will require to be stationary, there is no reason why accumulators weighing several tons each should not be constructed.

In applications in which movable accumulators are required, the increase of weight gives rise to the suppression of the very heavy and fragile glass vessels. The glass jar is now only used for the laboratory types, weighing less than 10 kilogrammes. Boxes of wood lined with lead are used almost exclusively. In certain applications where lightness is specially required, recourse may be had to ebonite, which is however a comparatively expensive material.

It has next been attempted to give to the accumulators as light a construction as possible, without diminishing their power of storage. The method employed consists in greatly increasing the active surface of the plates without increasing

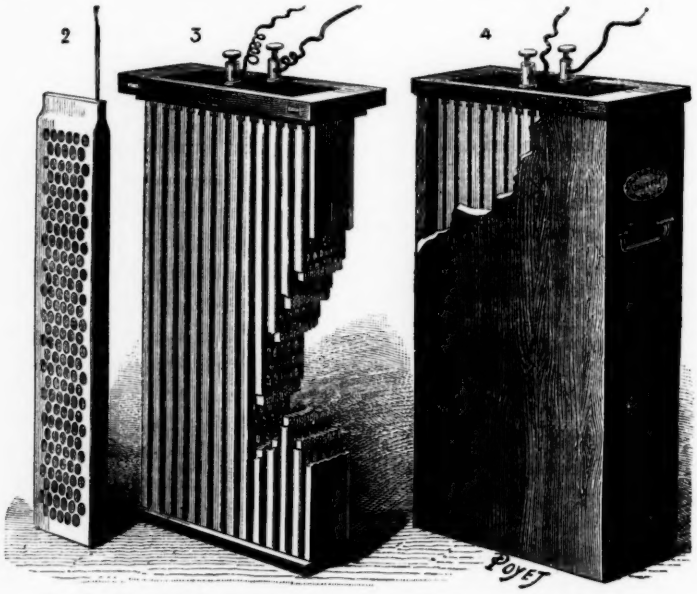


FIG. 3. SEPARATE PLATE. ARRANGEMENT OF THE PLATES. ACCUMULATOR—VERTICAL INDUSTRIAL TYPE.

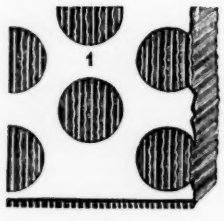


FIG. 1.
PORTION OF PLATE OF CORRUGATED ACCUMULATOR.

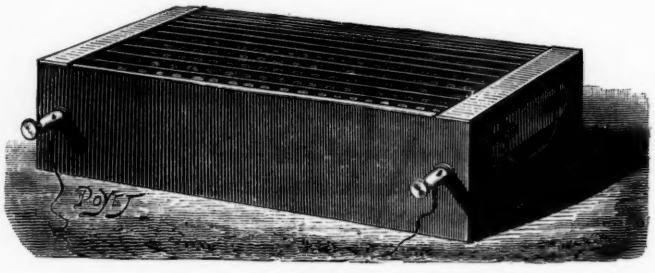


FIG. 4. HORIZONTAL INDUSTRIAL TYPE.

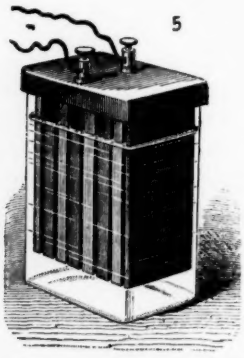


FIG. 2.—ACCUMULATOR—LABORATORY TYPE.

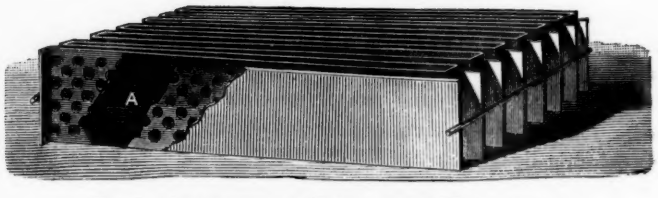


FIG. 5. ARRANGEMENT OF PLATES DURING MANUFACTURE.

the weight in the same proportion, for it is upon the surface, with a thickness very slight in comparison, that the reactions are produced which give rise to the secondary current. M. Faure, with the object of shortening the duration, has tried to increase the capability of storage, by increasing not the active surface, but on the contrary, the thickness of that active part, by giving to each side of the plates of lead a layer of minium, which the current oxydises and reduces during the formation.

The advantage, which is very considerable as regards the duration of the formation, does not seem so genuine as to the absolute power of storage. This is the opinion of M. Faure himself, who expresses it in a letter addressed to M. Hospitalier, April 10th, 1882, from which we give the following extract :—

"I have given great attention to the electro-chemical theory of my battery, and by repeated analyses of the material of the active layers of the electrodes at different stages of the charge and discharge, taking into account the current which had passed between two experiments, I thought I might assert that the effect immediately observable was the transfer of a certain quantity of oxygen from one electrode to the other, and *vice versâ*, according to the proportion established in electro-chemistry, and that during the discharge, for instance, the lead reduced became Pb_2O, whereas the peroxydised, lead Pb_2O_4, became Pb_2O_3. But I noticed that this only took place in a small fraction of the total mass of the layers, about ten per cent. I attribute this to the resistance offered by a half-solid substance, such as the sponge of lead and its oxides to the transmission of the electrolytic wave ; in fact, a considerable part of the mass escapes the action of the current. However, I have reason to believe that with the help of mixtures indicated in my patents and careful construction, I shall succeed in increasing very considerably the capacity of charge of my batteries."

Let us now come to the description of the accumulator, and see how a considerable increase of surface has been obtained, the weight at the same time remaining comparatively moderate. The battery consists of a series of vertical plates, the internal arrangement of which is shown in fig. 1. Each plate is composed of a series of slips of lead, one-tenth of a millimetre thick and of appropriate length.

These little plates of lead are alternately corrugated and plain, and are arranged alternately so as to form at length a sort of partitioned plate eight to nine centimetres wide, containing from eighty to one hundred little plates so arranged. They are held firm by means of a plate of lead, pierced with holes which envelops them, at the same time permitting the free circulation of the liquid (figs. 1 and 3). To each of the plates constructed in this manner is fixed a conducting rod which serves to connect it with the corresponding terminal. The vertical type (fig. 3) consists of twelve such plates connected alternately with the two terminals. The two end plates are simply sheets of lead, which bring the total number to fourteen. They are firmly fixed to the upper part of the case, and kept firm at the lower part by being embedded in an insulating compound composed of resin and paraffin.

In the laboratory type (fig. 2) the plates are smaller, only six in number, and placed in a glass case, which permits of the phenomena of the charge and discharge being studied. In the vertical industrial model (fig. 3), the case is of wood, lined with lead, and supplied with handles, which allow of its being easily manipulated.

The plates are about forty centimetres high, eighty-five millimetres wide, and one centimetre thick. The accumulator weighs thirty kilogrammes with its case, without liquid, and about thirty-five kilogrammes with water containing one-tenth acid, all ready to work.

The horizontal type (fig. 4) only contains ten plates, and weighs only twenty-five kilogrammes. It is less easily moved about, but it presents more stability, and is especially suited to fixed installations. The plates are fixed by their extremities, being embedded in the insulating cement, the middle being supported by slips of wood, which are removed after the hardening of the cement (fig. 5). The terminals are on the side of the box, which allows of the accumulators being placed one above another, in the form of a battery. The corrugated accumulators are as yet of too recent a date for us to be able to judge of their practical value. In any case, being constructed on the very principles laid down by M. Gaston Planté, they at least possess similar properties, at the same time offering industrial advantages which were wanting in the laboratory models constructed with a purely scientific object by that learned physicist.—*L'Electricien*, May 1st, 1882.

CABLE SHIPS.

NEW BOARD OF TRADE REGULATIONS.

THE Board of Trade have forwarded to Mr. Pender, M.P., for the information of the Telegraph Companies, "copies of the new Articles 5 and 27, which it is proposed to include in the revised regulations for preventing collisions at sea." They are as follows :—

"REGULATIONS FOR PREVENTING COLLISIONS AT SEA.

"Art. 5. (*a*) A ship, whether a steamship or a sailing ship, which from any accident is not under command, shall at night carry, in the same position as the white light which steamships are required to carry, and, if a steamship, in place of that light, three red lights in globular lanterns, each not less than ten inches in diameter, in a vertical line one over the other, not less than three feet apart; and shall by day carry in a vertical line one over the other, not less than three feet apart, in front of but not lower than her foremast head, three black balls or shapes, each two feet in diameter.

"(*b*) A ship, whether a steamship or a sailing ship, employed in laying or in picking up a telegraph cable shall at night carry in the same position as the white light which steamships are required to carry, and, if a steamship, in place of that light, three lights in globular lanterns, each not less than ten inches in diameter, in a vertical line over one another, not less than three feet apart; the highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character that the red lights shall be visible at the same distance as the white light. By day she shall carry in a vertical line one over the other, not less than three feet apart, in front of but not lower than her foremost head, three shapes not less than two feet in diameter, of which the top and bottom shall be globular in shape and red in colour, and the middle one diamond in shape and white.

"(*c*) The ships referred to in this article, when not making any way through the water, shall not carry the side lights, but when making way shall carry them.

"(*d*) The lights and shapes required to be shown by this article are to be taken by other ships as signals that the ship showing them is not under command, and cannot, therefore, get out of the way. The signals to be made by ships in distress and requiring assistance are contained in Article 27.

"SIGNALS OF DISTRESS.

"Art. 27. Every ship which is in distress and requires assistance shall make use of the signals named in this article.

"In the daytime.—The following signals, numbered 1, 2, and 3, when used, displayed together or separately, shall be deemed to be signals of distress :—

"1. A gun fired at intervals of about a minute;

"2. The International Code signal of distress indicated by N C;

"3. The distant signal, consisting of a square flag, having either above or below it a ball, or anything resembling a ball.

"At night.—The following signals, numbered 1, 2, 3, when used or displayed together or separately, shall be deemed to be signals of distress :—

"1. A gun fired at intervals of about a minute;

"2. Flames on the ship (as from a burning tar barrel, oil barrel, &c.)

"3. Rockets or shells, throwing stars of any colour or description, fired one at a time, at short intervals."

We have, in our issue of April 15th of this year, in an article headed "Legislation for Cable Property," expressed our opinion on the above subject, an opinion which we have as yet seen no reason to change. Time will probably prove the correctness, or otherwise, of the views put forward in the said article.

ELECTRIC LIGHT MEASUREMENTS.

By H. R. KEMPE.

VII.

MEASUREMENT OF RESISTANCE.

FOR measuring low resistances, such as have chiefly to be dealt with in electric light apparatus, there is no instrument so convenient as the "Metre Bridge." This instrument, which is shown by fig. 10, consists of an oblong board (forming the base of the apparatus) along which is stretched a German silver wire 1 metre in length and about 1½ millimetres in diameter. This wire runs parallel to a metre

scale divided throughout its whole length into millimetres, so that there are 1,000 divisions in all. The two ends of the wire stand opposite the 0 and 1,000 marks respectively. These ends are soldered to the extremities of a thick copper band, which passes round each end of the graduated scale and runs parallel to it on the side opposite the wire. This band is interrupted by four gaps, at y, x, R, and z respectively. The gaps at y and z are only required in special cases, to which it will be unnecessary to refer in the present articles; they should be kept permanently closed by thick copper straps connected to the terminals, the latter being tightly screwed down. R is a set of eight resistances of the

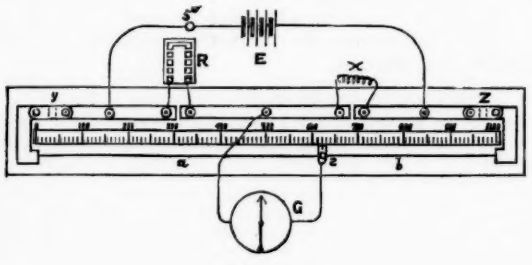


FIG. 10.

following values:—·1, ·2, ·2, ·5, 1, 2, 2, and 5 ohms. These numbers enable any resistance from ·1 up to 10 ohms (each resistance differing from the other by ·1 ohm) to be inserted. As a rule, the metre bridges are supplied with four separate resistance-bobbins of 1 ohm each; but a set of resistances, as described above, are more useful for the present purpose.

The galvanometer, G, is usually of the astatic form, with two needles suspended by a long silk fibre. The resistance of the coils must be low (about 1 ohm). The battery, E, should consist of about four large-sized Leclanché cells; the latter should be connected to the terminals shown, through the medium of a switch, S^w, so that the current can be cut off immediately a test is finished, and thus the running down of the cells be prevented. It is very important that this disconnection be effected when the bridge is not in use, as the battery is practically on short circuit when the switch, S^w, is closed. The simple disconnection of a battery wire from the terminal to which it is joined would answer the purpose required, but a switch enables the result to be effected in a more satisfactory manner, and, moreover, renders an omission less liable to be overlooked.

s is a slider connected to one terminal of the galvanometer, G; this slider does not normally make contact with the German silver wire (over which it slides), but it can be made to do so when required by pressing down a knob fitted to it. This knob forms the terminal to which the galvanometer connecting wire can be attached.

When the galvanometer needle is set at zero and the various connections made, the slider, s, should be set at the 500th division mark, the knob of the slider pressed down, and then sufficient resistance inserted in R to bring the galvanometer needle as nearly as possible to zero; this being done, the slider, s, should be slid along the graduated scale in one direction or the other, and the knob pressed down at intervals until the point is reached at which it is found that when this depression takes place the needle stands at zero exactly; when this is the case, then—

$$ax = \mathrm{R}b,$$

or

$$x = \mathrm{R}\frac{b}{a} \text{ ohms.}$$

but since $a + b = 1000$, or $b = 1000 - a$

therefore $x = \mathrm{R}\,\dfrac{1000-a}{a} = \mathrm{R}\left(\dfrac{1000}{a}-1\right)$ ohms.

Thus, for example, suppose that R was ·9 ohms, and that balance was obtained on the galvanometer, G, when the slider stood at the 512th division, then

$$x = \cdot 9\left(\frac{1000}{512}-1\right) = \cdot 9\,(1\cdot 9531-1) = \cdot 858 \text{ ohms.}$$

The metre bridge will enable a resistance to be measured to a considerable degree of accuracy, a movement of the slider to a distance of one division either to the left or right of the division which gives exact balance, being clearly indicated on the galvanometer, the needle turning to the right of zero in the one case, and to the left in the other. As by means of the adjustable resistance, R, we can in most cases enable the slider, s, to be close to the 500th division mark on the scale we can practically determine the value of a resistance to an accuracy of ·4 per cent.*

In cases where a resistance as low as 1-100th of an ohm has to be measured it would be necessary to make the resistance in R ·1 ohm, and then to move the slider, s, towards the left hand end of the scale; under these conditions the degree of accuracy with which the resistance can be measured becomes considerably reduced, for supposing the slider actually stood at the 910th division mark, then this would mean that

$$x = \cdot 1\left(\frac{1,000}{910}-1\right) = \cdot 0099 \text{ ohms;}$$

but a difference of 1 division in this case would mean an error of 1·2 per cent. approximately. It might be suggested that greater accuracy would be obtained by making R adjustable to ·01 ohms; this, however, is not practicable, for with resistances of such a low value, the resistance of the leading wires, and of the blocks between the plug-holes—and, again, the difficulty of causing the plugs themselves to make good contact in their respective holes—would introduce much greater inaccuracies than those which the arrangement would otherwise tend to remove.

Practically, then, we may say that we could measure a resistance of ·01 ohms to an accuracy of about 1 per cent., and any higher resistance than this to a correspondingly higher degree of accuracy, the highest degree being ·2 per cent.

If the 10 ohms resistance were inserted in R, and the slider, s, were moved to the 91st division so as to obtain zero on the galvanometer, then this would mean that a resistance of

$$x = 10\left(\frac{1,000}{91}-1\right) = 99\cdot 89 \text{ ohms}$$

is being measured. A difference of 1 division in this case represents an error of 1·2 per cent. approximately, so that practically we could measure a resistance of about 100 ohms to this degree of accuracy. A higher resistance than 100 ohms cannot well be measured with the metre bridge, as either the slider would, for this purpose, have to be moved beyond the 100th division mark to the left, or a resistance of, say, 100 ohms, would have to be inserted at R. In the former case, an error of 1 division would obviously mean a comparatively large inaccuracy in the calculated result; whilst, in the latter case, the sensitiveness of the whole arrangement would be so reduced that the slider might be moved several divisions from its theoretically correct position without producing a sensible effect on the galvanometer needle.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.

THE last ordinary general meeting for the spring session of this Society was held on Thursday evening, May 25th, 1882. After the usual formal business had been transacted, Lieut.-Col. C. E. WEBBER, R.E., the President of the Society, announced that the council had decided to offer three premiums annually for the best original papers sent in to the Society, the stipulations being that the papers should be on the subject of Telegraphs or Electrical matters, and that no member of council would be eligible as a recipient. The

* The formula for obtaining the error caused by the slider being 1 division out is—

$$\text{Percentage error} = \frac{100,000}{a\,(1,000-a)}.$$

three premiums were to be named—The Society's premium, value £10; the Paris Electrical Exhibition premium, value £5; and the third, the Fahie premium, value £5; the latter amount being the interest upon a donation made for the purpose by Mr. Fahie. The awards to be vested in the council of the Society, who would also have the power of withholding any or all of the premiums, should the papers not be considered of sufficient commendable merit. The value of the premiums to be represented by books or scientific apparatus, and no person to be entitled to receive more than one premium in any one year. The first premiums to be awarded to papers handed in between May 25th, 1882, and the end of May, 1883.

A paper was then read by Lieut. P. CARDEW, R.E., on "A New Method of determining large Electric Currents and very low Resistances." Three sets of apparatus were exhibited and described. One was a modification of the Obach galvanometer, consisting of the replacement of the usual horizontal galvanometer of that instrument by an astatic galvanometer consisting of a coil of fine wire of high resistance. The vertical coil was fixed at right angles to the astatic galvanometer, and consisted of a few turns of thick copper wire. By this arrangement a given deflection, taken from a standard cell by a current through the horizontal coil, would require a current 24,000 times as strong to produce the same deflection if the current were passed through the vertical coil.

The second instrument was intended to facilitate readings, and consisted of a sliding coil between two graduated scales, (a movement being obtained by turning a screw) from which the readings could be taken. The third instrument described had thick wire coil and a fine wire coil connected to four cups containing mercury, by which several alterations of connections could be made by bent copper rods dropped into the cups according to the test desired.

In the discussion which followed the paper—

Prof. AYRTON said that he doubted whether in practice the standard Daniell cell would be kept in proper order, as experience had shown indifference to exist in that respect on the part of some of those who made electric light experiments. In his opinion the instrument was hardly sufficiently dead-beat, though the whole arrangement showed great originality and ability.

Lieut. CARDEW replied that if the instrument were placed in the hands of those who were ignorant as to the proper management of a Daniell cell, failures no doubt might result.

A paper was then read on "The Organisation and Operation of the Field Telegraph Corps in the Transvaal in 1881, with some General Remarks on Field Telegraphs," by Lieut. A. W. BAGNOLD, R.E. The author described the rapidity with which stores were collected and men mobilised on receipt of orders to proceed to the Transvaal during the war there in 1881. On arrival, the corps, 52 in number, was not at first very kindly received by the Boers, who could not make their appearance consistent with the declaration of peace which had just been made. Very little opposition was offered, however, by the natives, and the only difficulties in the way of constructing a line of telegraph from Pietermaritzburg to near Pretoria were those inherent to the peculiarities of the country through which it passed. Lieut. BAGNOLD described in full detail the disposition of his men and the plan followed in surveying and construction, and stated that the party erected a line of poles and one wire 100 miles long in thirteen days. When native labour was employed it was a curious fact that the Kaffir who used a pick scorned to use a shovel, and *vice versâ*.

The paper was of very great interest to the military gentlemen present, who had mustered in good numbers to hear their comrades. The next meeting of the Society was announced for Thursday, November 9th, 1882.

THE troops at Aldershot, under the superintendence of General Sir Daniel Lysons, commanding, yesterday had a sham fight on the Fox Hills, about four miles from the camp. The chief feature in connection with the day's operation was the satisfactory combination working of telegraphy and flag signalling in the field. There were on the ground about 10,000 men, 1,800 horses, and 50 guns.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

THE CANDLE-POWER OF ELECTRIC LAMPS.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—In answer to the Editor's note appended to my letter, which appeared in your issue of the 20th inst., I have to say that I had no desire to make more public than necessary the Brush failures. You, however, demand, and I can only comply by quoting from the *Journal of Gas Lighting*, House of Commons, York, Dublin, Barnsley, Scarborough, and last not least, *Edinburgh*. To allude again to the power of the electric light, even so *great* an authority as Mr. Preece seems liable to overstate. In his letter to the *Times* of yesterday, he says:—"One horse-power gives a 2,000 candle-power lamp (alluding, no doubt, to Brush), while same power gives eight incandescent lamps of 16 candle-power each, equal 128." By his own showing the arc has a considerable advantage. He then concludes his letter by stating that Edison's big machine can produce 1,200 incandescent lamps of 16 candle-power, adding, equal 192,000. Should it not be one *cipher* left out?

ELECTRON.

May 25th, 1882.

THE TELEPHONE CASE.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Your lengthy report of the Telephone Case, viz., the United Telephone Company against Harrison, Cox-Walker & Co., for infringements of Bell's and Edison's patents for telephonic apparatus, will be read with great interest, as well by those who are pecuniarily interested in those patents as by inventors of other telephonic apparatus, and by electricians generally.

In reading your report every one must admire the legal acumen of Mr. Justice Fry, before whom the case was tried, and also be struck with his remarkably lucid and concise explanations of scientific, electrical, and physical facts and theories which were put forth many times in a very obscure manner by several of the distinguished scientific witnesses.

The shareholders of the United Telephone Company have reason to be well pleased—perhaps not with the judgment! but with the fact—that the Bell patent has thus far sustained its validity after a crucial examination of it in a scientific sense; and honest inventors and the commercial public have a clear, well-defined exposition, by the presiding judge, the eminent counsel and witnesses of the Bell patent, of its special merits and of its claims to novelty, and it is to be hoped that the United Telephone Company will rest satisfied with Bell's claims as thus expounded, and will abstain in future from setting forth such preposterous claims as that it "possesses the only telephone receiver which is of any practical use," and "that no person has a legal right to manufacture telephones in the United Kingdom," and it is to be hoped that inventors and instrument makers—now that Bell's legal claims are so clearly expounded—will not attempt to deprive the owners of Bell's patent of their well-paid-for property. After the thorough examination of Edison's patent and the explanations by the judge and by the counsel for the plaintiffs, I cannot think that the United Telephone Company will republish the erroneous statement that "no form of transmitter in which carbon or any other equivalent substance is employed can be supplied or used except under licence from the United Telephone Company." I will now briefly refer to portions of the evidence, which go to explain and establish the novelty of Bell's invention as described in his patent of December 9th, 1876, and what are the essential improvements upon Bell's United States patent of March 6th, 1876, published in Great Britain in July of the same year, and also the differences between the instrument called the Glasgow instrument, which was given to Sir

William Thomson by Bell, and exhibited by Sir William in Glasgow in September, 1876. Sir Frederick Bramwell, witness for plaintiffs, described Bell's instrument made under Bell's patent of December, 1876, in the following words :—"I find here a plate capable of inductive action, supported all around its edges in the neighbourhood of the pole and within the magnetic field of an electro-magnet."

Sir William Thomson, when asked what was the new invention of Bell superadded to the goldbeater's skin arrangement when he took his patent, replied : "One very important addition was dispensing with the battery in the line wire and in the main wire, in connection with a transmitter operating by a to-and-fro motion in the neighbourhood of a magnet. He substituted permanent magnets for electro-magnets, but not simply permanent magnets for electro-magnets, but permanent magnets, with electro-magnetic pole-pieces additional. Another difference was that of the metallic disc instead of the goldbeater's skin, and he considered them very important new inventions."

Sir William proceeded to say : "One most important part of the new invention is, the fixing of the vibrating iron or steel plates all around its edges."

Dr. John Hopkinson, for the plaintiffs, said : "He considered the novel features in Bell's patent were the use of a plate diaphragm, and the use of a permanent magnet, or an electro-magnet excited by a battery ; these were the two sole points of novelty."

This witness thought "that tongue vibration, which was what took place in the instrument exhibited by Sir William Thomson at Glasgow, was objectionable ; tympanic vibration was required."

The descriptions of Bell's invention as described in his patent of December 9th, 1876, by Sir Frederick Bramwell, Sir William Thomson, and Dr. Hopkinson, were accepted by the judge and the counsel for the plaintiffs, and must be taken as a fair and correct description, accepted by the United Telephone Company, and binding on it.

In order to fully appreciate those descriptions of Bell's new invention, relied upon by the United Telephone Company, I quote these claims of Bell's disclaimers :

6th Claim. "The combination in the manner described in the fourth and fifth plans, but subject always to the disclaiming notes, of an electro-magnet, with a plate of iron or steel, or other material capable of inductive action, which can be thrown into vibration by the movement of surrounding air, or by the attraction of a magnet."

7th. "In an electric-telephone the combination with the plate of a magnet having coils upon the end or ends of the magnet nearest the plate, substantially as described in the fourth and fifth plans."

8th. "In an electric telephone the combination with a permanent magnet and plate armature of a soft iron pole-piece forming the core of the coil, substantially as described in the fourth and fifth plans."

I now refer to remarks made by Mr. Aston, Q.C., in closing the case for the plaintiffs.

This eminent counsel said, "The whole case turned on the question of whether or not there was a publication of a receiver having a plate armature prior to December, 1876." Mr. Justice Fry here remarked that "if Mr. Aston claimed clearly and distinctly a receiver with plate-armature, that claim was embarrassed by so many conditions, that it was not a very easy thing to do." Mr. Aston at once replied that he did so claim. The figure by which he took his stand was A3, which denominated the whole of Bell's specifications in every figure and every description, and the armature then was a plate armature : "A plate armature was essential in the Bell," and, he insisted, "particularly in the fundamental distinction between the bar suspended pendulum-wise as in the Reiss, and the plate armature in the Bell."

I will now cite a few passages from the very able and exhaustive analysis of all the evidence by Mr. Justice Fry, in order to set forth in the judge's own words the legal claims as to novelty in Bell's patent of December 9th, 8176, being improvements in Bell's patent of March 6th, 1876, issued by the United States Patent Office, and published in Great Britain in July, 1876, this invention, described in the United States patent being, of course, public property in the United Kingdom.

Mr. Justice Fry, in his review of the evidence and speeches of the very learned counsel for the plaintiffs, said :—

In 1876 Mr. Bell had made an instrument which, in the first place, appears to have had a transmitter and receiver of the same character, each of those instruments consisting of a tympan or drum of membrane, which tympan or drum carried a piece of iron or an armature capable of producing inductive action. The receiver appears to have been constituted in the same way, and he appears in the first place to have used an instrument of that construction. But in August, 1876, at the Philadelphia Exhibition, he exhibited an instrument made after a somewhat different fashion; in that the transmitter consisted of a membrane charged with an armature or steel spring, while the receiver was an annular magnet furnished with a flat plate, the external portion—the annulus, in fact, of the magnet—being one of the poles, and the central core the other pole. It was, however, found that the membrane used in the tympanum was not entirely successful. That membrane had, as I have already observed, attached to it as an armature, a piece of steel wire, and the presence of that weight at a particular part of the tympan seems, according to the evidence before me, to have had some disturbing influence upon the action of the tympan itself. Furthermore, the membrane is liable to be influenced by changes of atmosphere and by the difference of moisture in the atmosphere; and as the receiver might be at a considerable distance from the transmitter, it is obvious that different atmospheric influences might operate on the two instruments, and therefore place them, not in harmony, but in discord. These difficulties in the way of the use of the membrane induced Mr. Bell, in memoranda of alterations, to point out that a great improvement had to be introduced into the instrument, by substituting for the membranous tympan a metal plate or disc, which, of course, was inductive in its own nature, and was free from the objections which were found to obtain in the case of the membrane. That as a whole the instrument disclosed by the letters-patent was new appears to me not to be doubted.

Has Bell's receiver then been anticipated by previous inventions or by public knowledge? Before considering the anticipations, I think it expedient to describe Bell's receiver as claimed by him, and as I understand it. It consists of a horse-shoe magnet, the ends of which are brought into the circuit by means of coils of wire, and in front of which is a metallic plate capable of inductive action, placed at right angles to the length of the magnet, resting, as regards its circumference, on the wooden case, the vibrations in which plate are the source of sound in the receiver; the plate described must be inductive and equivalent to a steel plate as regards its capacity to vibrate with the voice.

No one who has heard or read the evidence in this ably-contested case can doubt for a moment the justice of the judgment of Mr. Justice Fry : That the Hickley and Cox-Walker receivers are infringements of Bell's patent as amended.

I may, at some future day, have something to say about the invalidity of Bell's patent in consequence of prior publications. As the Bell patent now stands, it has been proved and adjudged that the combination of a plate armature, capable of inductive action in front of the pole of a magnet, or of an electro-magnet, is covered by Bell's patent, and the converse is, that the combination of a plate not capable of inductive action with a magnet, or with an electro-magnet, does not come within Bell's patent.

It seems useless to make any comments on that part of the case which concerns Edison's patent, because that patent has been judged to be void ; but, as a third disclaimer may be obtained, there will remain Edison's claim to "the combination of a diaphragm or tympan with tension regulators," to which no one will object, as it has been clearly demonstrated that the use of a tympan or diaphragm is not only unnecessary but prejudicial. I may hereafter write somewhat in regard to the very loose use of the words *tympan*, *tympanum*, and *diaphragm*.

Yours,

W. C. BARNEY.

SPAGNOLETTI'S FIRE ALARM.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Will you permit me to say, in reply to a letter dated May 18th and signed by "M.S.T.E." in your last issue, that I cannot agree with the writer of this letter, for I have not, to the best of my recollection, ever even seen or heard before of the "Globotype Telegraph" he refers to ; still I have no doubt he will do me the justice in agreeing with me thus far, that a man cannot be accused properly of copying or pirating from an instrument previously invented when he is quite ignorant of the existence of such an instrument, and this is my case. I may say I have no wish or desire to copy or take unfair advantage of any previous inventions, and if it has so happened that I have constructed an instrument similar to one that has been previously invented (although I am not prepared to admit that I have

really done so until I have had an opportunity of seeing the original, comparing the two, and judging for myself) as they are for different purposes apparently, one for telegraphing messages and the other for transmitting a signal only, giving an alarm of fire. I have no doubt, and I hope that I have not in any way damaged the interests of the inventor of the instrument I am wrongly accused of copying.

I am, Sir,

Your obedient servant,

C. E. SPAGNOLETTI.

Paddington, *May 30th*, 1882.

THE ELECTRIC LIGHTING COMMITTEE.

THE House of Commons' hybrid committee have now concluded the taking of evidence upon the Board of Trade's Bill for facilitating and regulating the use of electric light, and the last three days of that part of their inquiry were occupied by evidence in support of the electric lighting companies' claims. On the conclusion of this evidence on Tuesday the committee adjourned until Thursday, and intimated that during the interval they would adopt resolutions expressing the principles they thought should be embodied in the Bill, and at the same time examine such suggestions as the various parties might submit to them. This course of procedure was first announced on Monday, and then two or three opposing counsel expressed warm dissatisfaction, on the ground that they were under the impression that they could be heard upon their proposals before the committee came to any definite conclusion. Mr. Vaughan Richards, indeed, went so far as to say he had never before known of such a course being adopted; but Mr. Stanhope (the chairman) assured him that the original committee on tramways had adopted the same method, and, finally, the learned gentlemen were mollified by being allowed to lay amendments before the committee between then and Thursday. On that day the committee, he added, would meet again to communicate their decision, and then adjourn over the Whitsuntide recess in order to enable the parties to consider the resolutions adopted. Until the public bill is actually disposed of the committee will not take into consideration any of the half-dozen private electric lighting bills which are also referred to them.

When the committee reassembled on Friday, the 19th ult., having adjourned over Ascension Day,

Sir Frederick Bramwell, who had previously been examined in chief, was interrogated by various members of the committee. In the course of his replies he urged that any experiments to test the practicability and desirability of the electric light for general purposes should be made only over areas containing something like 50,000 inhabitants. He admitted that there might be some danger of fire through overheating of wires, but that danger he thought would be overcome as people became accustomed to the management of electric wires. He doubted whether it would be of any use to give the municipal authorities the right to make experiments, for he believed rather that they would wait till other people carried out the experiments, and then step in and take all the benefit by buying up the companies. If, however, any such authority desired to undertake such a work, they could apply to the Board of Trade for power, and he believed that department would always give them the preference over a private company applying at the same time. He further expressed the opinion that there would in future be a large demand for gas for heating purposes and for power.

At this point Mr. Banting Rogers, an electric light patentee, strongly pressed the committee to hear counsel on his behalf, and a representative of the Swan company put in a similar claim. The committee, however, declined to accede to Mr. Rogers's request, but promised to hear counsel for the Swan company, because certain new matters referring to lamps had been introduced.

Mr. William Spottiswoode, President of the Royal Society, was the next witness examined; and in reply to Mr. Moulton (for the Electric Lighting Company), he described the experiments he had made in both his town house and his country house, and declared the electric light to have now passed the experimental stage. He was satisfied that it could be relied upon to supply a whole community, and at a cost comparable with the cost of gas. Its advantages over gas were that it did not vitiate the atmosphere, did not create heat in rooms, and could be moved to any part of a room. He advocated an easy and simple method of authorising an installation of electric light where a community desired it, and urged that concessions should be allowed for 21 years; pointing out that the Board of Trade would be able to prevent the evil of any inefficient system being continued for that period.

In cross-examination by Mr. Richards, Mr. Spottiswoode said a concession of 21 years was necessary to enable the undertaking to make a fair return; and in reply to Mr. Littler (representing corporations) he said it was impossible to tell how electric lighting might be developed, and the conditions there were the better. The witness was also cross-examined by Mr. Michael, and re-examined by Mr. Moulton, and—

Replying next to the committee, he said it would be for the Board of Trade to secure sufficiently low tension and efficient insulation to prevent danger of fire. He thought accumulators would be a useful auxiliary in the event of any break in the current from a central machine, and in some cases electricity could be delivered at houses in accumulators. In that way a local authority might perhaps compete with a light-supplying company, but a large installation would be required; and he thought it would be more economical to get the electricity from an extraneous body. Sub-division of electric light had been effectually accomplished by means of the incandescent lamp. There ought, in his opinion, to be stringent regulations to insure a supply being adequate, and the proper insulation of the wires; and he was in favour of the wires being laid underground. Overhead wires would be subject to prejudicial influences, but they would not attract lightning.

Dr. Charles William Siemens was the next witness. He was examined by Mr. Rodwell, in answer to whom he said the application of electrical energy for lighting purposes had made considerable advance since the committee of 1879, and a great stride had been made in adapting it to domestic lighting by means of the incandescent lamp. The best effects had been produced by combinations, the arc light being cheaper in regard to motive power, while the incandescent lamp was best adapted to small places. If confined only to street lamps, the electric light would not be so cheap as gas for public purposes, but it would be economical if applied to both public and private purposes. What was wanted was permanent establishments in centres not too large for economical applications, and he thought that one-fourth of a square mile would be the proper range of one engine in a densely-populated district. That would require 2,000 horse-power, or 1,200 nominal, and if both public and private buildings were supplied the cost would be, roughly estimated, about £100,000. But the period of concession in such a case ought to be at least 21 years, because otherwise it would not be worth while to invest capital to set up the permanent machinery which was necessary. From his experience he considered that the conducting wires should be under the ground, and the mains might be laid near the surface in such a way as to involve little public nuisance. When not required for lighting, the engines might be utilised for producing power, and he had so applied electricity very largely on his own premises in this country. He did not believe electricity would altogether supersede gas, for gas might be largely used for other than lighting purposes.

In reply to counsel opposing, Dr. Siemens said it would be well to give a monopoly to one company for a time, but he would suggest that the districts should be of such a size that a municipal authority might have two or more systems working side by side in the one town in order to obtain the best system by comparison. If the area of supply was half a mile two wires of half an inch diameter would be sufficient. So far as the machines for producing electrical energy were concerned, they were now so perfect that mechanical energy could be converted into electrical energy with a loss of only 10 per cent.; but in regard to lamps he believed there would be great improvements in the future. At this point the committee again adjourned.

On Monday Dr. Siemens was further cross-examined, and, replying to Mr. Jeune, he mentioned that at Godalming eight private houses were supplied by 57 Swan lamps, while the public streets and other places were lighted by 6 arc lamps and 17 incandescent lamps. He thought that not more than 12,000 people, or about 1,500 houses, should be supplied from one centre of electric supply.

In answer to various remarks of the committee, Dr. Siemens said he did not consider it necessary that the Board of Trade should limit the amount of electromotive force passing through wires into houses, but he thought a clause might be inserted in the bill to prevent too much power being supplied to one house. Electricity at a high tension might be carried to the houses and then distributed in small quantities. Secondary Faure batteries might be placed in cellars and recharged periodically. He thought the cost of electric light would, speaking generally, be about the same as that of gas. Provisions against accidents would be necessary, and properly insulated wires should be insisted upon, under an efficient system of inspection. With 150 volts there would be no danger to life, but anything beyond that would be dangerous. Electric wires would only affect people if touched with both hands, and then only if their hands were damp. He had himself touched wires of 300 or 350 volts, but such a strength of current would certainly be dangerous to the human frame, and 450 volts would be higher than would be taken into a private house. With respect to the limit of charge in a wire it would be possible to transmit electricity of a greater potential than 500 volts if it was distributed by secondary batteries.

Dr. Hopkinson, F.R.S., Professor of Science at the London University, examined by Mr. Moulton, said the cost of electric lighting would depend very much on the system adopted, and on the character of the works; but he thought Dr. Siemens' estimate of £100,000 for a quarter of a square mile gave too high an idea of the cost. £200,000 per square mile might be taken as the probable cost. An electric system could be started on a small scale, and gradually enlarged, but it would be better at the outset to lay down the means on a liberal scale. Owing to the weight of the storage batteries it would not be practicable to carry them about for distribution, and he thought they would have to be fixed in the same way as water cisterns. He believed the cost of electric lighting for domestic purposes would be very much that of gas; but a short term of concession would very much affect that, and he considered that nothing short of 21 years would enable a thorough system to be carried out. No danger would arise from leakage in a wire which was near a wall, and leakage could be rendered impossible, except at a particular point: the weak point which would be provided to show when there was too strong a current. Electric supply being once defined by the Board of Trade there would be no difficulty in efficiently providing it, except through the disregard of the regulations. He did not expect that gas would be extinguished by electricity, for it would be largely required for heating purposes.

In the course of cross-examination, Dr. Hopkinson said his estimate of £200,000 was based on a calculation of 50,000 lamps, at a cost of £4 each; and he thought the cost of the electric light would vary according to circumstances, just as the price of gas varied. Electric light might be placed under conditions of supply similar to those of gas. There would be no difficulty in supplying power by day and light at night from the same machines; and, as he read the bill, the licences were to be for supplying both power and light.

In answer to Mr. Chamberlain, the witness explained that as the cost increased as the distance was lengthened it would be wise not to make too large installations. Gas engines were generally small, but one would be sufficient to work a single dynamo machine.

Dr. Hopkinson further stated in answer to other questions, that it would be perfectly possible to measure the quantity of electricity consumed in a house by means of plates dipped in a solution of sulphate of zinc. Leakage would fall on the supplying company, the consumer only paying for the electricity passing through his house. If storage batteries were used, the maximum supply which could be required would be provided, and in that way it would not be necessary to withdraw the supply for motive power in the event of a fog necessitating a supply of light at the same time. It was possible that some people would manufacture their own electricity, but it would be more economical for them to purchase it and have cisterns or reservoirs.

Sir John Lubbock, being called by Mr. Moulton, said there was no longer any doubt as to the practicability of electric lighting. He considered the limit of time in the bill too short, and that both licences and provisional orders ought to run for 21 years. It was doubtful how far the public would avail themselves of electricity, and as in consequence companies might hesitate to put up large installations, they should be encouraged by favourable conditions to establish systems on a large scale, for large installations only could be worked economically. The witness was briefly cross-examined by Mr. Richards, and the committee adjourned.

Mr. C. H. Johnson, the agent of Mr. Edison in this country, was the witness examined on Tuesday. He explained that the conditions necessary for the proper application of this system were :—means for the manufacture of electricity on a large scale, commensurate with any possible consumption; means for universal distribution over the whole of a given area; means for regulating pressure and controlling the strength of the current; means for utilising the current for light, heat, power, or other purposes, and for producing small or large units of work; means for protecting life and property; means for measuring the amount of electricity consumed; means for making units independent of each other; and means for insuring a constant supply. The cost of a supply for 33,000 ten-candle lamps in a square mile he estimated at £100,000; and economy and reliability could only be secured by large installations. If put under favourable conditions, electric light could be supplied at about the same price as gas. The concessions ought to be for 21 years. Electricity was now able to give a constant supply of light for any length of time. Machines were now constructed capable of generating 150 horse-power of electricity, and it was quite practicable to measure the amount consumed. The various conditions requisite for a successful installation were perfectly well known; but the wires must be laid underground. With a view to safety in a general distribution, a potential so low that it would not traverse the human body might be adopted. Danger of fire was met by various automatic devices based on the action of heat on metals, and they prevented a rise of temperature sufficient to cause fire. He believed electric lighting had not only passed the experimental stage, but had already become a *bonâ fide* manufacturing industry. When the supply of electricity was equal to that of gas it would be cheaper than the latter; and he anticipated that before long electricity would be in large demand for manufacturing purposes. The witness was cross-examined at some length by Mr. Richards, and then

Mr. R. E. Crompton was called. In answer to Mr. Moulton he said he had had large practical experience in electric lighting, and had put up several installations. He agreed generally with previous witnesses as to the conditions that should be adopted, and, according to an estimate he had made, the cost of lighting a square mile would be about £208,000. He believed a perfectly reliable supply could be provided if installations were on a large scale, and he suggested in regard to restrictions that the system should be placed under the supervision of the Board of Trade, just as ships and boilers and factories are.

Replying to Mr. Story-Maskelyne, Mr. Crompton said he had arrived at his estimate by assuming a residential district in which there were 4,000 houses to the square mile whose gas expenditure averaged £12 a year—that meaning seven burners each, lighted 2,000 hours in the year. To provide that amount of light he allowed 50,000 electric lights; but his estimate did not include the conducting of the current further than to the areas of the houses. There was no difficulty as to measuring the quantity used, but it was a question whether the meters would be tampered with.

Mr. Moulton then addressed the committee on behalf of the electric lighting companies, and the committee adjourned, as arranged, to Thursday.

The following resolutions were the result of the Committee's deliberations :—

1. That the Board of Trade be empowered to grant licences to local authorities, or to private undertakers, with the consent of such local authorities, to supply electricity within a defined area.

2. That such licences be for any period not exceeding five years, but may, at the expiration of the licence, be renewable with such consent as aforesaid.

3. That the Board of Trade be empowered to grant provisional orders to local authorities, or to private undertakers, without the consent of such local authorities, for the supply of electricity; but such provisional orders shall be subject to confirmation by Parliament.

4. That notice of any application for a licence or provisional order be given by public advertisement in the district, and full opportunity be given to all parties interested to state their case to the Board of Trade.

5. That no application for a licence or provisional order be granted until the expiration of three months from the notice of such application.

6. That no application by any local authority for a provisional order under this Act be proceeded with until it has been submitted to a meeting of the local authority, specially summoned for the purpose by public notice.

7. That licences and provisional orders should carry with them power to break up the streets for the purpose of laying the necessary wires.

8. That, where it has been proved to the satisfaction of the Board of Trade that any area as defined by licence or provisional order is sufficiently supplied with electric light, and that the supply of gas in such area has ceased to be remunerative, the Board of Trade be empowered to make an order relieving, either wholly or in part, any corporation or gas authority from being compelled to supply gas within such area.

9. That local authorities be empowered to purchase compulsorily the undertaking of any company or person authorised by provisional order to supply electricity at the end of 15 years, or at the end of any subsequent period of five years.

10. That for the purpose of the purchase of the undertaking the value of the land, buildings, works, materials, and plant shall be deemed to be their fair market value at the time of the purchase, due regard being had to their nature and their condition, to their state of repair, to their suitability to the purposes of the undertaking, and where a part only of the undertaking is purchased, to any loss occasioned by severance, but without any addition in respect of compulsory purchase, or of goodwill, or of any past or future profits, or of any similar consideration.

11. That licences and provisional orders should contain such regulations—(*a*) For securing the safety of the public from injury to life or from fire; (*b*) for inspection; (*c*) for securing a regular and efficient supply of electricity; (*d*) for fair prices—as experience may prove to be necessary; and where it has been proved to the Board of Trade that public safety is likely to be endangered, they shall at all times have power to make such further regulations as may be required for securing the safety of the public.

12. That overhead wires be forbidden without the consent of the local authority; and where it has been proved to the satisfaction of two justices of the peace or corresponding authority that any such wire is or is likely to become dangerous to the public safety, they may make an order directing it to be removed upon such terms as they may think fit.

13. That local authorities supplying the electric light be required to keep separate accounts of such undertaking, and to publish them in detail for the information of the ratepayers.

14. That the Board of Trade be required to submit to Parliament an annual report of their proceedings under this Act.

15. That any undertakings which may be authorised by private Acts for the supply of electricity be subject to the conditions contained in this Act.

The Committee stands adjourned until the 8th inst., when they will receive and consider amendments not contravening the principles of the resolutions at which they have arrived.

NOTES.

UNDERGROUND CONDUCTORS IN AMERICA.—There has been such widespread increase in improvements in the electrical art of late years, and overhead conductors have multiplied in such unprecedented numbers since the telephone and electric light systems have been introduced into the larger American cities, as to create a general demand on the part of the public that all the said systems should be put underground, and the streets freed from unsightly poles, which not only mar their beauty, but actually obstruct them. Already the municipal authorities in the larger cities of New York, Philadelphia, and Washington have demanded that their removal shall take place at as early a day as possible; and to this end also the New York State Legislature have referred the matter to a select committee, with power to examine expert witnesses as to the feasibility of forcing all electrical corporations into conduits with their conductors. This committee, in their report, state that, at the threshold of their inquiry, they were confronted with the fact that the obstruction of public avenues and thoroughfares in large cities by telegraph poles and structures was permitted in no other country than the United States. They question the existence of any authority for the obstruction. They find that in 1848 the Legislature authorised the formation of telegraph companies, with the right to construct telegraph lines "along and upon any of the public roads and highways, provided the same shall not be so constructed as to incommode the public use of said roads or highways." This Act was modified in 1853 by authorising such lines upon and over or under any of the public roads, streets, or highways, but subject to the same restrictions. Based upon this authority, telegraph and telephone companies have made the house-tops a base upon which, with countless numbers of poles which tower high above the houses, a network of wires are suspended. The expert testimony as to the feasibility of underground systems is overwhelmingly in favour of such a plan, based largely upon the undoubted success of like systems in France and England. In view of this evidence, the committee believe that the public cannot afford to wait the dilatory movements of the companies towards voluntary adoption of such subterranean systems, and that it will be wise to secure such adoption by positive legislation. To this end the committee recommend that legislative action be prompt and decisive, and that laws be passed forcing all electrical conductors underground in the larger cities, beginning with New York City. They also recommend that the corporations be required to remove all posts or other fixtures from all the streets, avenues, and highways in such cities within two years and six months. In Philadelphia a similar action is being urged, and the Common Council are decidedly in favour of a removal of all such obstructions. In Washington the leading capitalists have been asked to form a company to put down the Diedrich conduits, and the prospects are that, within the coming six months, the beautiful streets of this city will be freed from these nuisances.

THE SPANISH TELEGRAPH ADMINISTRATION.—A credit of half a million of pesetas has been placed at the disposal of the Spanish Telegraph Administration for the purchase of the necessary material in connection with opening the 800 railway telegraph stations for public service, and for the improvement in position of subordinate members of the staff. In next July Spain can count 1,200 telegraph stations at the service of the public.

TELEPHONES IN FRANCE.—M. Cochéry, the French Minister of Posts and Telegraphs, has asked the Chamber for a grant of 250,000 francs to enable him to establish a State telephone service between certain towns in France.

A NEW TELEPHONE COMPANY.—The Rogers' Secret Telephone Company has been incorporated in New York State with a capital of 10,000,000 dols. This company is designed for the purposes of insuring absolute secrecy in the transmission of telephonic messages in large cities, and uses the Rogers' secret telephone recently patented in the United States. The message is transferred over two different wires which are widely separated. This is done by means of a rotating transmitter which makes rapid contacts in succession over the different wires, thus dividing the message, so that if either wire is tapped the message is unintelligible. This telephone is now in use in Washington between the House of Representatives and the Executive Mansion, and works very satisfactorily.

RECEIVER FOR TELEPHONES.—Patent No. 256,907, filed in the United States of America Patent Office September 10th, 1881, by Robert M. Lockwood.

Brief.—A reduced flexible extension of the magnet-core is in contact with a piece of carbon attached to the centre of a diaphragm made of cork. The molecular vibrations of the magnet are communicated to the carbon and through the same to the diaphragm.

Claim.—In a telephone-receiver, a diaphragm of cork, provided with a central button of carbon or its equivalent, applied thereto substantially as specified, in combination with the magnet having the reduced elastic extension resting in contact with said button, substantially as and for the purpose described.

THE TELEPHONE.—The practical use of the telephone in regard to collieries is now being demonstrated in South Yorkshire. Apparatus has been fitted up at Oaks and Manver's Main Collieries, and from the surface to the workings. Conversation can be carried on with remarkable distinctness, allowing the state of the pits to be ascertained without delay, and permitting the taking of measures to avert threatened danger.

INFLUENCE OF THE ELECTRIC LIGHT ON THE SIGHT.—The influence of the electric light upon the sight is a subject likely to attract attention. Numerous observations, especially in France, lead to the undoubted conclusion that there is nothing prejudicial in the nature of the rays derived from the electric light, but, on the other hand, this light may be of great benefit by reason of its superior illuminating power. Indeed, it is highly probable that many eye diseases, myopia among others, are produced, and more are aggravated, by the strain of vision under circumstances of defective illumination. The sense of discomfort experienced, even by a possessor of good sound eyesight, who reads for some time in dim twilight, will demonstrate to any one the probability of what we have said. On the other hand, there is a risk attendant on the use of too bright illumination. Practically this effect is only in the case of those whose occupations in connection with electricity lead them into close relations with the light; but, even in such cases, the resulting inflammations, whether of iris or conjunctiva, are neither grave nor lasting. In the not far distant days of electric house illumination the companies may be trusted, if only for the sake of their pockets, not to do any serious injury to the general public by an excessive supply of light. It may, however, conduce to the peace of mind of nervous persons to know that even in such a case glasses suitably tinted will give relief. We must remember, however, that electric lighting is still in its infancy. Future scientific improvement may be trusted to remove what now is a more serious drawback to the light in a hygienic point of view than that of which we have spoken, viz., its unsteadiness. This once palliated, we shall find direct benefit, not only from the more perfect illumination, but also from the fact that this will allow of the lights being so placed that the eyes are protected, especially in near work, from their direct rays.—*British Medical Journal.*

THE ELECTRIC LIGHT IN THE UNITED STATES.—The United States Lighthouse Board has approved of the proposition to provide Hell Gate with electric light, and Congress has been asked to authorise the necessary experiments. From Massachusetts it is reported that the Merrimac Woollen Mills at Lowell, finding the electric light more costly and less agreeable than gas, have removed their sixteen lamps. On the other hand, it is stated that the Merrimac Cotton Mills are introducing the new Edison incandescent light.

COURT OF SESSION, EDINBURGH.—WINDING-UP OF THE SCOTTISH BRUSH ELECTRIC LIGHT AND POWER COMPANY.—This is a petition for the Anglo-American Brush Electric Light Corporation, Limited, asking the Court to wind up the Scottish Brush Electric Light and Power Company, Limited. It seems that on the 23rd November, 1881, an agreement was entered into between the petitioners and W. P. Hope, Leith, whereby on the narrative that he had proposed to the vendors, as owners of certain letters-patent, that he should form a company to introduce electric machines and lamps into Scotland, as preliminary to the formation of a company to be established on a wider and more extensive basis in the event of its being ascertained to be expedient and advantageous, it was agreed that Mr. Hope should procure the incorporation of a company under the Companies' Acts, with a nominal capital of £50,000, divided into 5,000 shares of £10 each. In consideration of the licence to be granted by petitioners, they were to be paid £10,000, and have 2,000 fully paid-up shares in the company, of the nominal value of £20,000. The Scottish Company was incorporated on 8th December, 1881, and the petitioners say that of the 2,000 shares above mentioned they hold, and are registered owners of, 1,900. A second agreement was entered into with reference to the establishment of a new company; and as the petitioners aver that their interests are being interfered with, they ask the Court to wind up the original company.

DIRECT SPANISH TELEGRAPH COMPANY.—The Lizard-Bilbao cable was interrupted on the 30th of April, and the ss. *H. C. Œrsted*, chartered by the Silvertown Telegraph Works, who had the repairing of this cable in hand, arrived off Silvertown on the 8th of May, and, after shipping the necessary cable and stores, left again the next day. On Sunday, the 14th ult., she hooked the cable and spoke to Falmouth. After the necessary tests had been made this end was buoyed. Owing however to the heavy weather in the Bay, the grappling operations for the Bilbao end had to be put off for some days. On Thursday night the Bilbao end was got up, and, after splicing on to the cable on board, paying out commenced towards the buoy on the Lizard end, but, bad weather coming on again, the operations of picking up the Lizard buoy and making the final splice were only performed with some difficulty and consequent delay. The final splice was slipped on Friday night, and the line was again open for traffic on Saturday, the 20th ult. The *Œrsted* steamed then to Le Palais Belle Ile for final instructions, and, on receiving a telegram that cable was all right, left this port on Sunday morning the 21st ult. for Silvertown, where she arrived on Wednesday morning. Mr. A. Le Neve Foster was in charge on board, assisted by Mr. A. S. Page, and great credit is due to them for the able way in which these operations have been carried out. After discharging cable and stores, the *Œrsted* returned to her headquarters at Copenhagen.

MEXICAN TELEGRAPH CO.'S EXTENSION.—The India-rubber, Gutta-percha, and Telegraph Works Co. have received a telegram from Mr. H. Benest, engineer-in-charge of the ss. *G. E. Wood*, announcing the safe arrival of that steamer at Galveston, Texas. She was to proceed at once with the laying of that portion of the Galveston-Tampico cable, which she carries on board. The ss. *International*, with the remaining portion, arrived at Kingston, Jamaica, on the 25th inst. all well. After coaling she proceeds to Tampico to complete the cable. Mr. Theophilus Smith joins the *International* at Kingston with Mr. J. Rymer Jones, and then takes charge of the expedition.

SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.—The council have determined that the society shall offer three premiums annually for the best original paper sent in to the society on telegraphic or electrical subjects during the session, by any person not being a member of the council of the society. The 1st premium will be called the Society's Premium, value £10. 2nd. The Paris Electrical Exhibition Premium, £5. 3rd. The Fahie Premium, £5. The awarding of the premiums will rest with the council to whom power is reserved of declining to award either or any of the said premiums in any year in which they may consider the papers offered as unworthy of the distinction. The premiums will consist of books or scientific apparatus. No person will be entitled to receive more than one of the said premiums in any one year. The first premiums will be awarded in 1883 for the best papers sent in between this date and the end of May next.

IMPROVEMENTS IN THE RUBBERS OF ELECTRIC MACHINES.—By G. J. Agostini.—Very fine charcoal powder is rubbed up with petroleum to a tough liquid, and spread with a brush upon thin cotton paper. The surface of the ordinary rubbers is covered with strips of this paper. They are not hygroscopic; give a good development of electricity, and cleanse the disc.—*Wiedemann's Beiblätter.*

COMPARATIVE EXAMINATION OF DIFFERENT KINDS OF STEEL IN REFERENCE TO THEIR MAGNETIC BEHAVIOUR.—By A. Pictet.—Seven horse-shoe magnets, as equal as possible, each consisting of three plates, the middle one of which projects beyond the outer by 9 millimetres, have the height of 150 millimetres, and an interior and an exterior distance between the limits of 25—35 millimetres. The plates are 14 millimetres in width and 4 in thickness. The keepers are cut out of soft iron, all alike, slightly rounded and

provided with hooks. All are heated to 300° to make them quite neutral.

These magnets were rubbed on a large electro-magnet, which was excited by a dynamo-electric machine. Soft keepers were laid upon the ends of the plates and remained there after the stroking. The strokes were performed as equally as possible by the aid of a seconds-counter. After the first stroke, the bearing powers of each plate separately and of all three together were measured. The best kinds of steel are Sheffield steels containing but little carbon.—*Archives de Genève.*

CARBON FOR GALVANIC ELEMENTS.—By R. Mauri.—Equal parts of graphite and sulphur are heated together in a suitable pan, till the sulphur melts, and the mixture is then poured into moulds in which a copper wire is laid in a zig-zag position.—*Wiedemann's Beiblätter.*

A NEW BATTERY WITH ONE LIQUID.—By M. Aymonnet.—Iron and carbon or platinum are placed in aqua-regia. The iron dissolves, forming ferric chloride, whilst the escaping nitrous oxide is passed over moist charcoal and regenerates sulphuric acid. In another combination, a mixture of bichromate of potash and hydrochloric acid is used. The electro motive force is rather greater than that of a Bunsen battery.—*Société Franc. de Physique.*

A GALVANIC ELEMENT.—By J. B. Oster.—Upon a plate of lead three to four millimetres in thickness, two centimetres in length and breadth, there is fastened by means of a layer of flannel peroxide of lead. The plate is coiled up spirally, a copper wire is soldered on, and the whole is enveloped in a lead casing bent together below. This roll is fixed in an earthenware cell. The latter is then placed in a glass cell containing also an amalgamated rod of zinc. Both cells are filled with dilute sulphuric acid.—*Wiedemann's Beiblätter.*

ATTEMPT AT A NEW REPRESENTATION OF THE FUNDAMENTAL ELECTRIC PHENOMENA.—By Stan. Doubrava.—The author has in this treatise taken up the line of research opened up by Faraday and since followed by Thomson and Maxwell. He drops the hypothesis of electric fluids, regards matter as the seat of electric energy, and in this department of science he considers the chief task of the physicist to be the discovery of the laws of the electric potential. Guided by the known analogy between potential and temperature he considers the former as the measure of the electric condition, just as the latter serves for the measure of the thermic condition. He then turns to the presentation of the fundamental experimental facts which at present appear incapable of further analysis, and, therefore, may be regarded as the principles of the theory of electricity. Of these he proposes three :—

1. The principle of polarity, in consequence of which we can never excite a certain potential without at the same time exciting in a second body a potential of the opposite sign. This principle forms an essential difference between electric energy and other forms of energy, *e.g.*, the thermic.

2. The principle of the transfer of the electric energy inclosed in a conductor to its surface. (Faraday's principle.)

3. The principle of the transformation of mechanical energy into electric, *i.e.*, the fact that the difference of potential of electric bodies can be altered by mechanical work.

By means of these principles—to which, indeed, are appended several other equally fundamental experimental facts, and which might therefore take the same rank as the above mentioned three—the author deduces the essential electric phenomena. He makes fruitful use of the conception of "lines of force" introduced into science by Faraday. He draws an interesting parallel between the lines of force on the one hand and the rays of light on the other. He suggests that these rays in electric (anisotropic) media are not necessarily vertical to their planes. Like Faraday he regards the difference between induction (electrostatics) and the current (electrokinetics) as merely gradual.

ON THE POLARISATION OF ELECTRODES AND THE CONDUCTIVITY OF LIQUIDS.—By M. E. Bouty.—In 1876 M. Lippmann described an electrometric method of measuring the conductivity of liquids. The principle as described in the *Comptes Rendus* for 1876 (p. 192) is as follows : the circuit of a battery P includes a known metallic resistance R, and a cylindrical column AB of an electrolyte. The electrodes A and B have a section equal to that of the cylinder, so that AB is traversed by a uniform current, and the potential has a constant value in the whole extent of a normal section aa' of the cylinder. Two metal wires m and n insulated and identical with each other are in communication with two sections aa' and bb', including between them the liquid resistance x to be measured. These wires can be connected with the two poles of a hair electrometer, and since in these conditions they do not give passage to any current, they are not polarised, and the difference of potential e which they present is equal to that which exists between the liquid sections aa' and bb'. Let i be the intensity of the current, we have—

$$(1) \quad e = ix.$$

By measuring the difference of potential of the two extremities of the known resistance R, we have—

$$(2) \quad \mathrm{E} = i\mathrm{R}, \text{ and consequently}$$

$$(3) \quad x = \frac{e}{\mathrm{E}}\mathrm{R}$$

$$(4) \quad i = \frac{\mathrm{E}}{\mathrm{R}}$$

M. Lippmann's method may be extended to the measurement of the electromotive forces of polarisation. Let us designate by p the polarisation of the electrode A, by r the resistance of the liquid cylinder Aa, the difference of potential y of the electrode A and of the wire m is composed of—1° the polarisation p of A ; 2° of the product ir, which would measure the difference of potential if there were no polarisation. We have then, in general—

$$(5) \quad y = ir + p.$$

When i and r have been measured by Lippmann's method, the equation (4) gives the value of p. In a first series of experiments, I determined the polarisation of platinum electrodes in acidulated water, as produced by currents of a very slight density.

Whatever may be the electric force of the battery, the polarisation of each of the electrodes is at first less than any measurable quantity ; it reaches its limit in a few minutes at the negative electrode, where it is smallest, and only in some hours at the positive electrode, where it is considerable. In any case it is the result of the passage of a current which traverses at first the voltameter with the full intensity determined by the electromotive force and the resistance employed, but which grows progressively weaker in proportion as the alteration of the surfaces of contact of the electrodes and of the liquid gives rise to polarisation. To each value assigned to the electromotive force and to the resistance there corresponds a limit value of the total polarisation, always less than the external electromotive force, and there is set up a permanent current of such intensity as to maintain this limit of polarisation. In one of my experiments, and for an electromotive force of 1 volt, the permanent current is such that it would decompose 0·009 grm. of water in about three and a half years. The total polarisation is 0·83 of the external electromotive force, and the current represents the 0·17 of that which the battery would yield in the resistance employed if the polarisation did not exist. I insist intentionally upon these facts, although they were in part known before my researches. It is necessary to call them to mind in order to establish the signification of the measurements which I am about to describe. Several physicists are inclined to ascribe to liquids two sorts of conductivity : the one *electrolytic*, assumed to explain the passage of the intense currents which set at liberty the products of electrolysis ; the other, *metallic*, to which is ascribed the transfer of the small quantities of electricity which traverse an electrolyte when the electrolytic force employed is insufficient to effect its decomposition. These two kinds of conductivity, superimposed in the conditions which have been hitherto adopted for measuring the conductivity of liquids, ought to be found separated in my experiments. It was therefore important to measure the conductivity of acidulated water when employing a very feeble electromotive force, *e.g.*, that of a zinc-cadmium element. The electrometric method of M. Lippmann allows this measurement to be effected without difficulty. Two troughs containing acidulated water and holding the one the positive, and the other the negative electrode. They com-

municate by means of a long capillary syphon, likewise filled with acidulated water, and the difference of potential at the ends of the wires is measured by means of two wires, from which the resistance of the liquid thread contained in the syphon is deduced. In these experiments, the electromotive force varied in the proportion of 1 to 32, and the intensity of the current as 1 to 176; the resistance of the liquid thread remained invariable at less than one-fiftieth for the feeblest intensities, and less than 1-150th for the strongest. This is precisely the limit of exactitude which the use of the electrometer admits of in these conditions. In other experiments made with liquid threads less resisting, it has been practicable to vary the intensity from 1 to more than 900, and either produce or suspend at will the development of gas at the electrodes. The resistance of one and the same liquid thread remained always invariable. A liquid, therefore, has only one manner of conducting electricity, whatever may be the particular phenomena of which the electrodes are the seat.—*Comptes Rendus.*

ON THE POLARISATION OF THE ELECTRODES AND ON THE CONDUCTIVITY OF LIQUIDS.—By M. E. Bouty.—In a former memoir (*Comptes Rendus*, xciv., p. 1243), the author has pointed out how the polarisation of the electrodes and the conductivity of liquids may be measured separately. He now explains the chief results of the application of this method to the case of mixtures. The liquid to be operated on is placed in a rectangular tank, at the two ends of which are the electrodes A and B, of the same size as the trough, and coated with varnish on their hinder surfaces. Two parasitic wires, M and N, coated with an insulating material, except at their extremity, dip into the liquid. Each determination comprises:—1. The measurement of potential at the two extremities of a known metallic resistance, comprised in the circuit, from which the intensity of the current is deduced. 2. The measure of the difference of potential between the two parasitic wires, from which is deduced the conductivity of the liquid. 3. The measure of the difference of potential between one of the parasitic wires and the nearest electrode, from which the polarisation of the electrode is deduced. The author has chiefly studied the case where one of the elements of the mixture is a salt of copper, and where the electrolysis is effected between copper electrodes.

Previous experiments had shown that when the sulphate or the nitrate of copper is mixed either with distilled water or with a salt of a more oxidisable metal, the electrolysis produced by currents of feeble intensity give always a brilliant and very adhesive deposit of copper; but for a density of current—density of current is the intensity of the current referred to the unity of the surface of the electrode—so much the more feeble as the liquid is more dilute, and the foreign matter in a larger proportion, there succeeds to the metallic coating a non-adhesive deposit, red or black. At the same time there may be observed by means of an electrode thermometer a development of parasitic heat, of which the negative electrode is the seat, and which is permanent with stronger currents.

The study of conductivity and of polarisations shows:—

1. The conductivity of the liquid remains constant notwithstanding the variety of electrolytic reactions of which the electrodes may become the seat.

2. This conductivity is always much greater than that possessed individually by the solution of any one of the elements of the mixture at the degree of dilution at which it exists in the liquid. Consequently the molecules of each of the mixed salts take part in the transportation of the electricity even when one only of the metals is deposited at the negative electrode.

3. The polarisation of the positive electrode may generally be neglected.

4. The polarisation of the negative electrode, very feeble for currents of moderate density increases rapidly above and below the particular density which causes the above-mentioned brown deposit to appear and tends for each mixture to a determinate limit. An outside value for this limit may be found of admitting that for a sufficient density of current the salt, whose decomposition requires most heat (between the electrodes employed), is the only one electrolysed. Thus in a mixture of sulphate of copper and zinc placed between two copper electrodes, the decomposition of the sulphate of zinc alone would produce an electromotive force of polarisation of 1 Daniell; in a mixture of sulphate of copper and sulphate of soda between the same electrodes; the decomposition of the sulphate of soda alone would produce a force of about $\frac{3}{4}$ Daniell. These numbers coincide respectively with the maximum of polarisation observed in the mixtures poorest in sulphate of copper.

The mechanism of the liberation of parasitic heat accompanying the polarisation is easy to interpret. Let there be, *e.g.*, a mixture of sulphate of copper and sulphate of zinc. When the zinc begins to deposit it forms with the copper a series of local couples in which the zinc is the attackable body. The metal is consequently redissolved, precipitating an equivalent quantity of copper, and the corresponding heat is entirely liberated in the circuit of local couples, *i.e.*, on the very surface of the electrode. These local currents between unequally polarised points of the electrode appear to play a considerable part in the limitation of the polarisation for each value of the density of the current. The diffusion of the products of electrolysis when gaseous and that which is executed between unequally concentrated strata of the electrolyte play perhaps a still more important part.

The author's experiments show that the electrolytic reaction which appears at the electrodes for feeble current-densities absorbs always less heat than those which succeed it for higher densities. This extension to the case of mixtures of the law announced by M. Berthelot for the case of simple electrolytes is confirmed in a tabular view which the author has drawn up. According to Wiedemann, if we form a mixed solution of any two metals belonging to the following list: zinc, cadmium, lead, copper, silver, gold, the metal which follows in the list is deposited to the exclusion of that which precedes. The author's experiments further show that the electrolysis of the salt of the first metal will appear in turn for a sufficient density of current. —*Comptes Rendus.*

BRUSH MIDLAND ELECTRIC LIGHT AND POWER COMPANY, LIMITED.—An extraordinary general meeting of the members of the above company was held in Cannon Street Hotel, on Thursday afternoon last, Mr. James Whitehead presiding. The secretary, Mr. H. N. Myers, having read the notice convening the meeting, the Chairman said: Gentlemen, the meeting to-day is of purely a formal character. I apprehend it is known to most of you that before you can obtain settlement and quotation on the Stock Exchange the committee of that body go very carefully through the articles of association in the interests of the shareholders and of the public who are interested in any given company. They have done so in the case of this company, and there are two articles to which they take exception, and I may say that the exception they take to them meets entirely with the approbation of the whole of the directors of this company. In accordance with the suggestion made to us, and made entirely in concurrence with the opinion of our legal advisers, we recommend the shareholders to-day to pass resolutions with a view to the alterations suggested. It is unnecessary for me, I think, to detain you at any length by any explanation of the object of the meeting, because it is quite clear upon the face of it what the object of the alterations is. I will therefore move the first resolution, which perhaps some gentleman in the room will be kind enough to second, "That the articles of association of this company be amended by striking out the fortieth article." Mr. John Parsons seconded the motion, which was carried *nem. con.* The Chairman: The second resolution is, "That the article of association of this company numbered forty-one be amended by striking out the following words in the third and fourth lines of the said article, namely, 'or the person entitled to the share by transmission as the case may be.'" Mr. Philip Jolin seconded, and the motion was likewise carried. The Chairman: The third and last resolution that I have to propose reads as follows:—"That the article of association of this company numbered 112 be amended by striking out the words 'or otherwise interested,' occurring in the fifth line of the said article." Mr. Richard Glyn seconded the motion, which was also adopted. A vote of thanks to the chairman was passed on the motion of Mr. Henry Russell Evans, seconded by Mr. John Parsons, and the proceedings terminated.

NEW COMPANIES REGISTERED.

MANCHESTER AND DISTRICT EDISON ELECTRIC LIGHT COMPANY, LIMITED. — Capital £600,000, divided into 50,000 A and 10,000 B shares, of £10 each. Objects: To purchase the right to use the inventions of the Edison Electric Light Company, Limited, in the County of Lancashire, for £50,000 cash and the 10,000 fully-paid B shares. Signatories (with 200 shares each): J. H. Agnew, Manchester; *W. Mather, Salford; *V. K. Armitage, Rochdale; *E. Cross, Bolton; *J. C. Lee, *C. Moseley, and *J. C. Waterhouse of Manchester. Directing qualification, 200 shares. The shareholders in general meeting will decide directors' remuneration, but £5,000 is to be the maximum annual amount. Registered 22nd ult. by Waterhouse and Winterbotham, 1, New Court, Lincoln's Inn.

ELECTRIC LIGHT SYNDICATE, LIMITED.—Capital £3,000 in £50 shares. Office, 99, Gresham House. Objects: The business of an electric light and power company in all branches. Signatories (with one share each): C. Kirby, 17, Gloucester Road, Camberwell; G. Vincent, 41, St. Alban's Buildings, Finsbury; J. G. Glover, Surrey Lodge, Kennington Road; W. H. Calthrop, 19, Church Street, Kensington; H. Byrne, Mortlake; G. S. Ullathorne, C.E., Hammersmith; W. T. Hannam, 3, Tadmore Street, W. The signatories appoint the first directors. Qualification, two shares. Remuneration, £100 per annum for each director. Registered 25th ult. by W. Hannam and Co., 99, Gresham House.

SCOTTISH, PILSEN, JOEL, AND GENERAL ELECTRIC COMPANY, LIMITED.—Capital £200,000 in £5 shares. Objects: To purchase certain patent rights upon the conditions of an agreement of 19th ult. between Frank R. Evans and Duncan McInnis, and to carry on the general business of an Electric Light Company. Signatories (six of whom subscribe for 50 shares each), *Alderman E. Knight, 101, Cheapside; *V. B. Tritton, St. George's Square, S.W.; *J. D. Dawson, 12, Ryder Street, St. James's; *Lieut.-Gen. W. A. Crommelin, C.B., Putney; *D. Parrish, 2, Copthall Buildings; *F. P. Fellows, Reform Club; D. McInnis, 50, Bernard Street, W.C. (one share). Directing qualification £250 in shares or stock; remuneration £1,500 and 20 per cent. of the balance of net profits after payment of an annual dividend of 10 per cent. upon the issued share capital. Registered 25th ult. by Clarke and Co., 14, Lincoln's Inn Fields.

SINGLE WIRE MULTIPLE TELEPHONE SIGNAL COMPANY, LIMITED.—Capital £5,000 in £10 shares. Objects: To carry on the business of a telephone company, and particularly to acquire the letters-patent of 1882, numbered respectively 2995 and 5140, for improved telephonic signals. Signatories (with one share each) *Wm. H. Davies, 17, Cornhill; Wm. Flux, 17, Warrington Crescent; H. A. C. Saunders, 107, Grosvenor Road, Canonbury; G. R. Neilson, 66, Old Broad Street; A. C. Brown, 299, Lower Road, Rotherhithe; H. C. M. Anderson and W. H. Burman, 10, Throgmorton Avenue. Mr. Davies is appointed general director of the company. Registered 25th ult., by Flux, Son and Co., 3, East India Avenue.

HOME, FOREIGN, AND COLONIAL ELECTRIC LIGHT AND POWER SHARE TRUST COMPANY, LIMITED. — Capital £1,500,000 in £10 shares. Objects: To purchase and hold shares and other securities of electric light and power companies. Signatories, with one share each:—Francis J. Hanley, 27, Nicholas Lane; C. Bouts, 60, Wiltshire Road, Brixton; A. E. W. Wood, 16, St. John's Wood Park; Wm. Scott, 108, Bishopsgate Street; C. W. Gay, 88, Bishopsgate Street; C. Reade, 29, Kellett Road, S.W.; T. W. Lee, 2, Pancras Lane, E.C. Registered 26th ult. by T. W. Lee.

* Signatories whose names are preceded by an asterisk are also directors.

NEW PATENTS—1882.

2311. "Improvements connected with sub-marine cable grapnels and their appliances, and in means of establishing electrical communication between the grappling vessel and the bottom of the sea for detecting the presence or position of cable, or through the cable grappled to the shore." Sir J. ANDERSON and W. C. JOHNSON. Dated May 17.

2318. "Improvements in electric-motors, applicable also to electric generators." J. A. CUMINE. Dated May 17.

2335. "Fittings for electric lamps." C. DEFRIES. Dated May 18.

2336. "Dynamo or magneto or electric machines and apparatus for lighting railway carriages, cars, or vehicles, by electricity." T. J. HANDFORD. (Communicated by W. A. Stern and H. M. Byllesby.) Dated May 18.

2340. "Construction of dynamo-electric machines." C. W. VINCENT. (Partly communicated by W. B. F. Elphinstone, Baron Elphinstone.) Dated May 18.

2348. "Incandescent electric lamps." S. H. EMMENS. Dated May 18.

2349. "Electrical apparatus." S. H. EMMENS. Dated May 18.

2357. "Improved means, apparatus, or appliances for enabling persons to ascend to the tops of chimney stacks, church spires, and other high places for the purpose of rebuilding or repairs or for fixing lightning conductors, weather vanes, or for other like purposes." T. W. W. BARRETT. Dated May 19.

2364. "Dynamo-electric machines." R. WERDERMANN. Dated May 19.

2370. "Electric arc lamps." J. BROCKIE. Dated May 19.

2387. "A novel mechanical cab, to be actuated by foot or hand, or both, or by electrical or other compact motive power; the principle of construction being also applicable to light vehicles generally or "Tahytrohon." N. D. SPARTALI. Dated May 20.

2391. "Secondary batteries, applicable also to primary batteries." J. PITKIN. Dated May 20.

2397. "Application of electricity as a detector in the safely closing of windows and doors of dwelling houses, banks, and stores." B. COYLE. Dated May 22.

2408. "Machines for coiling wire." H. H. LAKE. (Communicated by G. Gale.) Dated May 22.

2409. "Electric accumulators or secondary batteries." H. H. LAKE. (Communicated by H. Lory.) Dated May 22.

2414. "Insulating materials or articles." J. A. FLEMING. Dated May 22.

2416. "Electric batteries." H. H. LAKE. (Communicated by J. B. Wallace.) Dated May 22. (*Complete.*)

2419. "Electric arc lamps." W. H. AKESTER. Dated May 23.

2421. "Improved construction and arrangement of apparatus for exhibiting advertisements and the like by day, and rendering the same visible by night, and in the combination therewith of means or appliances for supplying electricity as the lighting or illuminating medium." J. HICKISSON. Dated May 23.

2425. "Improvements in incandescent electric lamps, and in the carbons therefor." J. J. BARRIER and F. F. DE LAVERNÈDE. Dated May 23.

2428. "Telegraph printing and time regulating apparatus." J. IMRAY. (Communicated by A. A. Knudson.) Dated May 23.

2432. "Incandescent electric lamps." G. G. ANDRÉ. Dated May 23.

2437. "Telephonic apparatus." W. R. LAKE. (Communicated by C. E. Chinnock.) Dated May 23.

2451. "Telephone transmitters." C. MOSELEY. Dated May 24.

2452. "Incandescent electric lamps." J. WETTER. (Communicated by L. Nothomb.) Dated May 24.

2456. "Driving dynamo-electric machines." J. SWALWELL. Dated May 24.

2466. "Telegraphic and telephonic apparatus." W. R. LAKE. (Communicated by F. van Rysselberghe.) Dated May 24.

2480. "Manufacture of compounds suitable for electrical insulation and other purposes." F. FIELD. Dated May 25.

2491. "Secondary batteries." C. W. VINCENT. (Partly communicated by Baron Elphinstone.) Dated May 25.

2501. "An improved combination of materials to be employed as an insulator for electrical purposes." B. RHODES and G. BINSWANGER. Dated May 26.

2512. "Incandescent electric lamps." E. W. BECKINGSALE. Dated May 26.

2516. "Preparation of materials to be employed for the purposes of electric insulation and other purposes." G. S. PAGE. Dated May 26.

2518. "Mode and manner of incorporation and manufacture of compounds suitable for electrical insulation and other purposes." G. J. PAGE. Dated May 26.

2519. "An exhausting apparatus to be used in preparing incandescent electric lamps." W. H. AKESTER. Dated May 27.

2527. "Dynamo or magneto-electric machines." W. R. LAKE. (Communicated by J. J. Wood.) Dated May 27. (*Complete.*)

2531. "Armature for dynamo or magneto-electric machines." W. R. LAKE. (Communicated by J. J. Wood.) Dated May 27. (*Complete.*)

2532. "Dielectrics." E. W. BECKINGSALE. Dated May 27.

2554. "Vulcanising india-rubber." J. H. JOHNSON. (Communicated by H. M. F. J., Comte de la Tour du Breuil, and A. M. A., Vicomte de la Tour du Breuil.) Dated May 30.

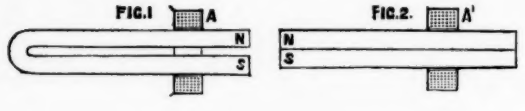
2557. "Illuminating of railway carriages by electric or other lights." M. A. WIER. Dated May 30.

2558. "Improvements in and relating to the generation, storage, distribution, regulation, and utilisation of electricity and apparatus or devices therefor, and means for producing or manufacturing parts of such apparatus or devices." J. S. WILLIAMS. Dated May 30.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

4439. "Incandescent electric lamps." J. JAMESON. Dated October 12. 6d. Consists, firstly, in an improved method of providing sealed-up relays of mounted carbons or other filaments intended for incandescence in vacuous electric lamps, and in arrangements whereby, on the failure of a carbon or filament it may be removed from its position and a fresh one may be substituted without access to the interior of the lamp and without destroying the vacuum; such substitution of fresh carbons being continuous as required until the whole number of filaments provided in reserve and sealed up be used in succession; and, secondly, in making provision for cleaning the inner surface of the glasses of electric lamps without destroying the vacuum The inventor prefers to employ for the replacement of carbons such arrangements as are sometimes used for the display of stereoscopic photographs, consisting of an endless band passing over two rollers and bringing each picture into a vertical position by itself successively; the filaments are mounted on a series of bars having insulation between the points at which the ends of the filaments are attached, and to make the electrical contact by pressure of the connecting wires on fixed points in the mechanism and on the roller nearest to the light, the movements of the carbons are operated by means of clockwork wound up before insertion in the lamp, but restrained from movement by means of a catch which may be released at will by means of a magnet outside, or by gravity by alteration in the position of the lamp, or wholly by magnets outside. For the purpose of cleaning the interior of the lamp a small pad or brush is provided having a piece of iron fitted into it. When it is desired to bring the cleaning operation into action the pad is allowed to pass into the globe of the lamp and a strong magnet is applied to one side of the lamp so as strongly to attract the pad. The lamp is then revolved so as to cause the pad to move over the entire surface of the glass with a pressure corresponding to the magnetic attraction.

4448. "Electro-magnets for telephonic and other purposes." JOHN IMRAY. (A communication from abroad by J. Milton Stearns, junior, of New York.) Dated October 12th. 6d. Relates to the construction and adjustment of the astatic cores of electro-magnets in such a manner that their armatures or diaphragms are attracted whatever be the direction of the electric currents through their coils, and to means of communicating telephonically through such a magnet from a transmitter that is extraneous to the circuit in which the magnet is situated. When no adjustment is required for the astatic



core, it consists of a simple bar magnet bent at its middle, so as to bring its two opposite poles nearly or closely together. These two poles are then near their extremities inclosed within a coil of insulated wire, or each may have on it a separate coil forming part of circuit. Electric currents of either direction being transmitted through this circuit will cause the magnet to attract an armature or diaphragm presented to the poles. Fig. 1 shows a magnet of horse-shoe kind with both its limbs encircled by the coil A; fig. 2 shows two separate magnets laid side by side with opposite poles adjoining each other.

4450. "Effecting telephonic communications." J. IMRAY. (A communication from abroad by J. Milton Stearns, jun., of New York.) Dated October 12. 6d. Relates to an arrangement of the line wires and their connections at the telephone exchange, and a method of operating therewith so as to facilitate the making and breaking of the telephonic connections, and to produce appropriate signals guiding the official in his duties.

4454. "Instruments for measuring electric currents, &c." JOHN TOBY SPRAGUE. Dated October 12th. 6d. Consist chiefly in improved forms and modes of construction of instruments described in Patent No. 4762, A.D. 1878. In instruments for indicating the currents passing at any moment and called galvanometers, the inventor uses soft iron magnetic needles, in which the current itself induces the magnetism. Instead of winding the wire or conductor in straight lines around the frame as usual, a part of the current is caused to pass at right angles or other suitable direction. The wire itself is either bent in portions of its course in the required direction, or a special magnetising circuit is made, either as a derivation or as a continuation of the conductor. The wire of this circuit is wound in a semicircular form so as to surround the space in which the needle plays, and so that in any position of the needle the wire shall cross it at right angles.

4455. "Secondary batteries or apparatus for effecting electrical storage." J. W. SWAN. Dated October 13. 4d. When a Planté cell is constructed of simple plates of lead a very considerable time is required to effect the change necessary to render them capable of storing a large amount of energy. The object of the invention is to avoid this disadvantage by so preparing the lead plates that they are capable of rapid transformation into the condition necessary for large storage. The object stated is accomplished by cutting or scraping the surface of the lead plates employed to form the storage cells in such a manner as to expose a greatly enlarged surface to the action of the electrolytic gases produced in the act of charging, whilst at the same time leaving sufficient solid metal to give the plate the requisite stability and hold the oxidised portions adherent to the body of the plate.

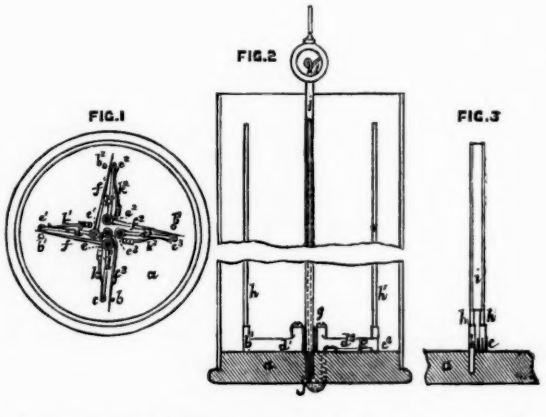
4472. "Electric meter." C. V. BOYS. Dated October 13. 6d. Relates to means of measuring and registering the quantity of electricity passed through a conductor, as, for example, the quantity transmitted from a battery or other source of electricity to electric lights or to machines worked by electricity. For this purpose clockwork is provided with an escapement governed by a pendulum or balance, the oscillations of which are determined by the force of an electro-magnet or solenoid having its coil in the electrical circuit, so that according as a less or greater quantity of electricity passes through the circuit the amount of movement permitted to the clockwork is less or greater. A counter connected to the clockwork shows by suitable indices the quantity of electricity that passes in a given time. In order to secure accuracy of indication the escapement should be of the dead beat kind, incapable of giving such impulse to the pendulum or balance as would cause it to oscillate. The clockwork may be driven by a weight or spring wound up from time to time by hand; the inventor prefers however to render it self-acting by combining with it a remontoir apparatus, which, when required, is acted on by an electro-magnet in the circuit, straining a spring or raising a weight that keeps the clockwork going.

4496. "Regulators for electric motors." JOHN HENRY JOHNSON. (A communication from abroad by La Société Anonyme La Force et la Lumière Société Générale d'Electricité, of Brussels.) Dated October 15. 4d. Relates to apparatus for regulating or controlling the speed and power of electric motors. The essential part of the improved regulator or rheostat consists of an ordinary metallic chain. This device presents a series of approximately similar points of contact capable of being pressed together simultaneously, with a force which admits of being readily applied or removed by straining or slackening the chain. When the chain is tightly stretched the resistance is comparatively slight, but when it is slackened or allowed to hang loosely the resistance is considerably increased. The degrees of tension intermediate between these two conditions produce corresponding variations in the resistance, so that by means of a conductor of this description all degrees of resistance may be obtained between the two extreme limits. The range between the two limits increases in proportion to the number of links in the chain. (*Provisional only.*)

4504. "Electric arc lamps." J. BROCKIE. Dated October 15. 6d. Has reference to certain improvements in the construction of electric lamps which regulate on the periodical principle, where the carbons are momentarily allowed to touch each other at certain intervals and then be separated again the requisite distance by the action of a magnet and clutching device.

4518. "Apparatus for driving or operating sewing machines by electricity." HENRY HARRIS LAKE. (A communication from abroad by Jean Joachim Journaux, of Paris.) Dated October 17. 2d. Provides means whereby a sewing machine may be driven by means of electricity or by the foot of the attendant at the will of the latter, and is carried into practice in the following manner, that is to say:—An electric-motor is provided which may be of any suitable kind and which is arranged to act upon the sewing machine by means of elastic and variable friction. (*Provisional only.*)

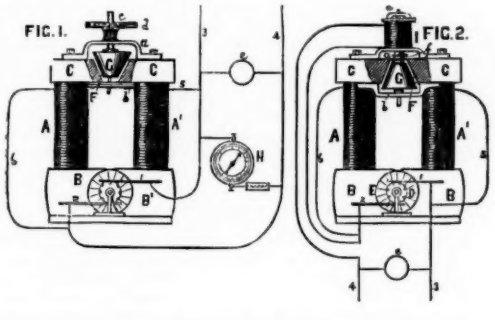
4533. "Electric lamps." R. R. GIBBS. Dated October 18. 6d. Relates to electric lamps, such as the Jablochkoff, in which there are two or more candles consisting of carbons placed side by side and parallel or nearly parallel to each other, and in which as soon as one candle is consumed another is automatically kindled. The objects are to cheapen the construction of such lamps, to render the action certain, to simplify the mechanism, and to enable them to be kept in order and used by any ordinary or unskilled attendant. Fig. 1 is a plan, and fig. 2 a view, partly in elevation and partly in section, of an electric lamp constructed in accordance with the invention. *a*, table, of ebonite or insulating material; *b*, b^1, b^2, b^3, metallic sockets secured to the said table; *c*, c^1, c^2, c^3, sockets carried by the metallic levers *d*, d^1, d^2, d^3. The said levers are free to move on the pins *e*, e^1, e^2, e^3, and are prolonged beyond the fulcrums, *e*, in the form of springs



f, f^1, f^2. The lever, d^3, terminates at the fulcrum pin, and the spring, f^3, is carried on a separate bearing, *g*; *h*, h^1, carbon pencils held in the sockets, *b*, *c*, and separated by the insulating material, *i* (see fig. 3); *j*, j^1, conducting wires connected to the dynamo machine or source of electricity. The interior wire, *j*, is connected to the spring, f^3, and through it to the fixed socket, *b*. The other or exterior wire, j^1, is connected to the lever, d^3, and through it to the movable socket, c^3.

Springs k, k^1, k^2, k^3, secured to the table, a, act on the levers, d, and sockets, c, and move them into contact with the fixed sockets, b, at the desired times. The action of the apparatus is as follows:—A current of electricity passes by the wire, j, to the fixed socket, b, thence through the carbons, h, h^1, to the movable sockets, c. The current then passes through the lever, d, spring, f, lever, d^1, spring, f^1, and so on to the spring, f^3, and conducting wire, j^1. When the candle, h, h^1, has been consumed below the lower edge of the insulating strip, i, the spring, k, moves the lever, d, until the sockets, c and b, are in contact. The spring, f, is at the same time moved into contact with the socket, b^1. The current then passes through the candle held by the sockets, b^1, c^1. As each candle is consumed the next succeeding candle is brought into circuit and until the whole are burned. The pieces of carbon pencils remaining in the sockets are then removed and replaced by fresh candles. When the last candle of the series has been consumed the spring, k^3, moves the lever, d^3, and socket, c^3, into contact with the socket, b^3, so that the continuity of the circuit is not broken, and there is no interference with the current passing to other lamps on the same circuit. When there is a separate circuit for each lamp the terminal sockets, b^3, c^3, may be fixed.

4552. "Dynamo or magneto-electric machines." PETER JENSEN. (A communication from abroad by Thomas Alva Edison.) Dated October 18. 6d. The object of this invention is to produce simple and efficient means for regulating the generative force of a dynamo or magneto-electric machine, so that only the amount of current needed in a circuit may be supplied thereto and the pressure or electromotive force maintained constant in the circuit. For this purpose in one case the principle is made use of that the power of an electromagnet can be weakened by diminishing the mass of the yoke connecting the cores, and that such power can be strengthened by increasing the mass of said yoke until the maximum power is attained. In applying this principle, the yoke of the field of force magnet of a dynamo or magneto-electric machine is provided with a movable portion, the position of which can be varied so as to affect the mass and conducting power of such yoke, said movable portion acting as a magnetic circuit regulator. This movable portion is preferably situated in the centre of the yoke, and is of conical shape, being supported by a spindle, which passes through bars connected with the top and bottom of the yoke, and separated therefrom by plates of brass or other non-magnetic material. The position of this movable cone may be adjusted by means of a hand wheel working on the screw-threaded stem of the cone, or the cone may be drawn into the yoke by an electro-magnet (preferably an axial magnet), the coils of which are in a shunt or derived circuit from the main or consumption circuit or directly in the main circuit. This magnet forms means for adjusting the cone automatically. Fig. 1 is an end elevation of a



dynamo or magneto-electric machine and connections with the yoke partly broken away to disclose the magnetic circuit regulator, and fig. 2, a similar view showing the magnetic circuit regulator operated automatically by the electromotive force of the main or consumption circuit through an electro-magnet. A, A^1, are the helices of the field of force magnet; B, B^1, the pole ends of the same; C the yoke or bar connecting the helix cores; D the revolving armature of the machine; and E the commutator block. The commutator brushes or springs, 1, 2, lead from the block, E, to the main or consumption circuit, 3, 4. The field of force magnet may be energised by the derived circuit, 5, 6, or by the main circuit of another generator. The yoke, C, has a central conical opening, F, passing vertically through it, in which plays the conical block, G, forming the magnetic circuit regulator. This cone is supported by bars, a, b, secured to the yoke and separated therefrom by brass plates. The stem, c, of the conical block may be screw-threaded and receive above the bar, a, a hand wheel, d, having an internal screw-thread, by turning which hand wheel the position of the cone with relation to the yoke can be adjusted. The translating devices represented by e are in derived circuits, while an electro dynamometer, H, is also situated in a circuit derived from the main circuit, 3, 4, and serves to guide the attendant in his adjustment of the magnetic circuit regulator. When the electromotive force increases beyond the desired intensity the attendant retracts the cone, and *vice versâ*, and thereby diminishes or increases the energy of the field of force magnet, and consequently the electromotive force of the current induced in the bobbin of the revolving armature. It is possible, therefore, by these means to maintain a nearly constant pressure or electromotive force in the main circuit, 3, 4. In fig. 2 an axial magnet, I, is used to draw the cone into the yoke, the same being retracted by a spring, f, and by its own weight. The coil of this magnet is in the main or consumption circuit.

4553. "Charging and using secondary batteries." PETER JENSEN. (A communication from abroad by Thomas Alva Edison.) Dated October 18. 6d. The object of this invention is to produce method and means for maintaining the electromotive force of a current supplied wholly or principally from secondary batteries, so as to utilise such secondary batteries in systems for the distribution of electricity for translation into light, power, heat, or other visible effect. This is accomplished by reinforcing the primary current from time to time, so as to keep up the required electromotive force in the main or consumption circuit.

4571. "Measurement of electricity in distribution systems." E. G. BREWER. (A communication from abroad by Thomas Alva Edison.) Dated October 19. 6d. The object of this invention is to produce method and means for determining the aggregate consumption of electricity in a distribution system from the central station where no individual meters are employed, or for ascertaining at the central station the correctness of the total consumption shown by all the house meters, so as to furnish data for comparison with the meter accounts, and further at the same time to determine the amount of leakage in order that the cause of any unusual waste of energy by leakage can be investigated and removed. This is accomplished by arranging at the central station of the system or point of generation a meter or meters for the measurement of electric currents which will give the total current generated by the dynamo or magneto-electric machines and thrown into the main or consumption circuit, and also a meter for recording the total leakage throughout the system, the difference between the former and latter representing the total amount of the electricty used by the consumers. These meters can be of any efficient construction, the electro-plating or depositing cell meters being preferred. The meter or meters for measuring the current generated by the dynamo or magneto-electric machines can be arranged in any one of three ways. A single or double meter could be located in a shunt from the derived or multiple arc circuit of each machine between the positive pole of the machine and the positive main feeding conductor, or a single or double meter could be placed in a shunt from the positive main feeding conductor between the machine or machines and the branch conductors, or a meter (either single or double) could be arranged in a shunt from the positive conductor of each branch or consumption circuit. In any case this meter or these meters would be at the central station or point of generation, and would indicate the total current thrown into the consumption circuit by the generators, only a portion of the current, however, being shunted through the meters, as will be readily understood. The meter for measuring leakage is in a line from ground to the return or negative main feeding conductor, the leakage of the system producing the flow of an equal current from the ground to the generators.

4582. "Lighting of railway carriages, &c., by electricity." A. M. CLARKE. (A communication from abroad by Madame Joséphine de Changy, *née* de Deyn, of Paris.) Dated October 19. 2. The object of this invention is to equalise the current produced, and prevent the extinction of the light during stoppages, and thus to enable railway and other carriages and steam-boats to be lighted by electricity for an indefinite period of time. The invention consists in the combination of secondary batteries with a magneto-electric machine, driven by an axle or shaft of the railway carriage or steam-boat, the office of the machine being to keep the batteries fully charged during the running of the carriage or steam-boat, in order that they may furnish the necessary current to maintain the light during stoppage of the machine. (*Provisional only.*)

4591. "Generating electricity." H. J. HADDAN. (A communication from abroad by Gregoire Dessaigne, of Villefranche, France.) Dated October 20. 2d. Has for its object the universal production of electricity by utilising the rotary motion of machines, electricity being generated without any additional cost, or a great deal cheaper than by the working of a dynamo-electric machine proper. This is done by utilising the power of fly-wheels by adjusting magnets on them (preferably at their felloes), and placing bobbins or electromagnets around such magnets, or I make the magnets fixed, and the bobbins movable if preferred. (*Provisional Protection not allowed.*)

4632. "Secondary batteries." J. S. SELLON. Dated October 22. 2d. Relates to the construction, preparation, and manufacture of secondary batteries of a strong, durable, portable, and convenient form, for the storing, magazining, or reserving electricity; and it consists chiefly in so arranging the respective elements, that a great amount of energy can be concentrated in a small space, and great lightness, durability, and facility for charging be obtained. (*Provisional only.*)

4659. "Lighting by gas and electricty combined." R. H. COURTENAY. Dated October 25. 6d. Has for its object to increase the illuminating power of gas hydrocarbons, methylated spirits of wine, or any fluid or substance from which artificial light can be obtained by the use of gaseous products therefrom by means of currents of electricity flowing through suitable media, thereby rendering the combustion more perfect, and preventing the injurious effects of the imperfect combustion of gas as used in the ordinary way. A current of electricity will decompose and precipitate carbon from a flow of gas, and the inventor has ascertained, by experiment, that if a flow of gas is regulated to allow only sufficient to pass through a burner which a current of electricity can consume, that the whole of the particles of carbon in the gas undergo electrical change and complete combustion, whereby the ordinary yellow light is converted into a pleasant white light. One of the methods by which this invention can be accomplished is as follows:—The most simple method is to increase the resistance of iridium, or an alloy of platinum and iridium, or other metallic or other suitable medium, by rendering the metallic or other medium incandescent by means of gas or other flame during the time a current of electricity is flowing through the metallic or other medium, thereby increasing the electrical resistance of the medium employed to such an extent that with the combination a white light can be obtained with ten cells of an ordinary Bunsen battery, or an equivalent current, from any other source, with about

one foot of gas per hour. Whereas ten cells alone only slightly redden the resisting medium. It will be understood there are in the above arrangement two burners, one supplying a gas or other flame, the second, an incandescent electrical burner placed in circuit of any source of electrical power, the medium being placed in a suitable position in the flame, producing the result described. A second method of combining gas with electrical currents is the forming of carbon gas and electrical burners combined, the same being perforated through their length, and thus rendering each electrode a gas burner through which the gas flows at the same instant as the current; or the insulation between the carbons can be made with perforations, and the carbons solid, by this arrangement the gas being in the centre of the arc. A third method of constructing gas-electro burners is to affix perforated carbons to a reservoir or reservoirs of gasoline, or other suitable hydrocarbons or methylated spirit of wine, or other suitable fluid, and through which the gas flows, the effect being the prevention of rapid consumption of the carbons or other media employed.

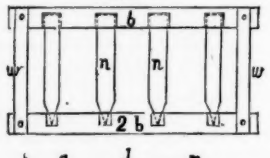
4664. "Electrometers." J. IMRAY. (A communication from abroad by Jules Carpentier, of Paris.) Dated October 25. 2d. Relates to the construction and arrangement of an apparatus or instrument for measuring the relative intensity of two electric currents, and also for ascertaining under certain conditions their relative electromotive force and for measuring resistance. (*Provisional only.*)

4694. "Apparatus for actuating signalling apparatus on railways by means of electricity." E. EDWARDS. (A communication from abroad by Etienne Lesbros, of Valence, France.) Dated October 27. 2d. Relates to discs or other signals, the position of which can be varied as desired, used on railways, and actuated by an attendant at a distance from the place where they are fixed. It has for its objects improved methods of constructing and arranging mechanism actuated by electricity, by means of which the position of the signals can be varied as desired. (*Provisional only.*)

4695. "Utilising electric circuits for various purposes, &c." W. F. BARRETT. Dated October 27. 8d. Relates to the method whereby a line used for telephonic or telegraphic purposes may also be employed for the purpose of keeping clocks or other time measurers in unison, for giving notice of burglaries or fires, or for other purposes, and which can be especially adapted to special safes for burglar or fire detection. For this purpose the inventor makes use of Retchie's or other system of periodic time control from a central station, and the invention consists in adapting to the controlling and controlled clocks electric contacts, which the clock automatically opens and closes at certain times. During the day, or such times as may be most convenient, the controlling and controlled clocks each complete the circuit leading from the line wire to the telephonic or telegraphic apparatus, except for a short period, say, 10 to 30 seconds, when the telephone circuit is broken and the line placed in the clock-controlling circuit.

4905. "Apparatus for the transmission and reproduction of sounds." W. C. BARNEY. Dated November 9. Has reference to a microphonic transmitter without a diaphragm, and to a new form of telephonic receiver. Fig. 1 represents one form of the transmitter; in the latter the bars are not attached to any material, but form two

FIG 1



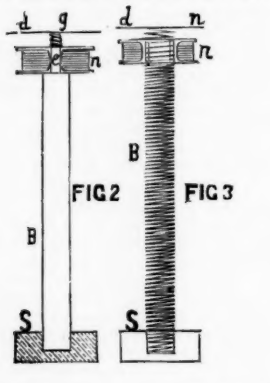


FIG 2 FIG 3

opposite sides of a frame, the other two sides being of wood, ebonite, or any non-conducting material; in holes sunk in one of the bars, 2*b*, stand loosely the bevelled ends of pencils, *n*, and in separate holes sunk in the other bar, *b*, the other ends of the pencils, which are square, rest loosely. In this microphone the pencils incline at an angle of five degrees from the perpendicular, which position renders them extremely sensitive to sound-waves, and the square ends prevent great area of surface-contacts. The sound-waves fall directly upon the carbons. Figs. 2 and 3 represent forms of the receiver according to this invention. In fig. 2, B is a bar of iron or of steel permanently magnetised, having one end fastened to a shoe, S, of soft iron, equal in weight to about five times the soft iron elongation, *e*, of the other end, on which is placed a bobbin, *n*, to the end of this elongation is fastened a short spiral spring, *g*, of iron, extending about half an inch above the end of the core. The end of this spiral electro-magnet may be capped with a disc of iron or steel, the same size as the end of the core or larger, or the terminating convolutions of the spiral spring may be wound in a plane gradually diminishing to a centre. The diaphragm, *d*, or tympan is firmly held around its edges between blocks of wood or ebonite, and the centre of it is pressed against or firmly secured to the end of the spiral spring, and the diaphragm necessarily vibrates with the molecular elongations and shortening of the electro-magnet, produced by the undulations of the electric current passing through the bobbin. In fig. 3, B is a wire of iron, or of steel permanently magnetised, made into a spiral spring, one end attached to a soft iron shoe, S, with a bobbin, *n*, about half an inch below the end of the spiral spring, with a soft iron core inside that part of the spring encircled by the bobbin, the convolutions of the spring above the helix to be contracted to the size of the diameter of the core; the end of the spring to be arranged as in the first form, and attached to a diaphragm of magnetic or non-magnetic material.

4775. "Electric lamps." H. A. BONNEVILLE. (A communication from Leo Daft, of New York.) Dated November 1. 4d. The first part of the invention relates to electric light mechanism, and it consists in certain specific devices or their equivalents, whereby the carbon sticks usually employed are automatically adjusted and kept in such a position and relation to each other that a continuous and effective light shall be had without the necessity of manual interference, as well on a single lamp as when a series of lamps are used in the same circuit; also to the arrangement and construction of the frame supporting the electric lamp, whereby a perfect insulation between the two carbons is effected and the light is improved. The second part of the invention relates to means for hanging or suspending electric lamps, especially from the ceilings or other parts of a building.

1882.

380. "Automatic electro-magnetic piano and organ players." C. N. ANDREWS. Dated January 25. 6d. Relates to certain new and useful improvements in automatic piano and organ players, in which the key of a piano-forte or the reed valve of an organ is operated by the opening and closing of an electro-magnetic current, and the object of the improvement is to provide a means whereby an organ or piano may be played upon by opening and closing a current of galvanic electricity by separating from each other or by bringing together the opposite poles of a battery by means of an interposed perforated strip of non-conducting material, through the medium of which the sound is produced.

616. "Machinery for purifying middlings." W. R. LAKE. (A communication from abroad by the Electric Purifier Company, Incorporated, of America.) Dated February 8. 6d. Relates to improvements in electrical apparatus for separating from ground or broken wheat or other grain or material the lighter particles which depreciate the quality of the flour if permitted to remain, such apparatus being commonly known as "middlings purifiers." In practising the present invention the principal features of the invention described in the specification of former letters-patent dated February 18th, 1880, No. 727, are employed. In that specification rolls were shown so arranged as to present an electrified surface over the material to be operated upon, which moves in an agitated state beneath the revolving rolls, so that the lighter particles are attracted by the electrified surface of the rolls, and by the movement of the said rolls are taken away and stripped therefrom. The object of the first part of the present invention is to use reciprocating plates as a substitute for the revolving rolls shown in the said former specification, retaining in the said plates the electrified surface whereby the impurities are attracted from the material passing in an agitated condition beneath them, and the first part of the said invention comprises the combination with a receiver for the ground material, which will by agitation or otherwise cause the material to gradually pass over its surface, of an electrified plate or plates arranged to move in a plane substantially parallel with the plane of the grain carrying or agitating device and devices which will remove from the said plate as it moves back and forth the particles which may be attracted thereto from the ground material.

CITY NOTES.

OLD BROAD STREET.

THE ANGLO-AMERICAN TELEGRAPH COMPANY, LIMITED.*

AN extraordinary general meeting of the above company was held in Cannon Street Hotel on the 25th ult., Viscount Monck presiding.

Mr. T. H. Wells having read the notice convening the meeting,

The Chairman said: Gentlemen, before I call upon the solicitor to read the agreement which you have been called together to affirm to-day I think a few words of explanation on my part would be desirable to show you for what purpose you have been called together, and also to explain to you the policy of your directors in the transactions in which we have now engaged. Gentlemen, it will be in your recollection that on the last occasion that we met in this room I told you your directors were pursuing the policy—a new policy—with regard to the apprehended competition with the United States cable which had been recently laid down. That policy, I told you at the time, was purely tentative and experimental. It was a policy which was directed, by reducing the tariff to a low rate, to the object of so increasing the traffic that all the cables in existence would be filled, and that the distributing of profits would be then brought about by an automatic and natural process, instead of dividing them, as we are about to-day to do, by the artificial means of an agreement between

* Abstracts of this and the following reports appeared in our last issue.—ED. ELEC. REV.

the companies concerned. Gentlemen, I told you at that time that the policy which I have indicated to you, and which I then explained, was a tentative and experimental policy. Of course its success depended exclusively on such an increase of traffic as would enable us to fill all the cables which are in existence. If all the cables which are in existence could be kept in full work it is plain that each company would receive its own share of the profits without any agreement or any artificial process for the purpose of distributing them. The fact that all the cables were in full work would render it impossible for any one company to get more than its real share, because it would not take more than its cable would enable it to perform. I also told you at that time that your directors had not had sufficient experience of this low tariff, and the results which it would produce, to enable them to say definitely whether that policy ought to be persevered in in your interests. Gentlemen, I come before you here and now, on the present occasion, to suggest to you that the experience we have had of that policy was not sufficiently encouraging to induce us to persevere in it, although we still consider that possibly, though that would only happen in the long run, and at some comparatively distant period, our anticipations may be fulfilled. Gentlemen, we ought to consider, in your interest, whether it was worth while, for the possible result which I have pointed out to you, to submit in the meantime to a considerable loss of money, which must be the necessary result of the policy that I have alluded to. Gentlemen, in the meantime the Jay-Gould cable, as it is denominated, was laid down. It became an accomplished fact. We knew, from our previous experience, that any cable in a good condition, and carrying its traffic in a satisfactory manner, will, in its competition with us, obtain a certain proportion of the traffic; and as we do not see our way, from the experience we have had of the low rate of tariff, that we should be able to extend our traffic so largely that it should fill all the cables, we thought, on the whole, a cable being laid down, competition being certain, and looking to the fact that the American cable would take a considerable proportion of the traffic, we came to the conclusion that it was best, on the whole, for your interests, to come to an agreement with the company. Gentlemen, we have not arrived at that conclusion without some hesitation. It has been said more than once in this room that we are going on sharing the traffic with every successive competitor, and that we shall continue that process until there will be no share left for ourselves. Well, gentlemen, unfortunately we have not the control of those who instituted these competitions; if we had we should keep for ourselves a monopoly of traffic between Europe and America. But unfortunately that is beyond our power. There are some things which directors can do and some things which they cannot do. They can endeavour to manage your affairs with a due regard to economy and efficiency, but they cannot prevent others coming in and sharing the traffic or endeavouring to obtain a share of the traffic, which every one who chooses to lay down a cable in the Atlantic can do. That being the case, we have nothing to do when a cable is laid down but what men of common sense always do under such circumstances, that is, accept the situation and make the best of it. My belief is that in making this agreement we have made the best of the situation, such as it is. We have obtained an agreement which gives us, as we are entitled to, being the oldest and largest company of all those engaged in the traffic, much the larger proportion of the receipts. We have, incidentally to the agreement, established a connection with all the land lines of North America, which, so far as any agreement will guard us, will guard us from competition in the future. But, gentlemen, while I say that, I should not be dealing honestly and frankly with you if I told you that any agreement we can make with existing companies will guard us continually from competition. If we made a good thing of it, you may depend upon it there would be some people come to hand to try and share the profits with us, and even when we are not, as I am sorry to say we have not, been paying a bloated dividend, you see that people think that they could do better than we can do, and are willing to risk their money on the speculation. Therefore, though I believe we have made an engagement which secures, as far as any agreement can, a monopoly of the American traffic, yet we must be prepared for further competition, and when this arises to meet it to the best of our ability. However, gentlemen, that is a matter of the future. And what we have now to deal with is the agreement we have entered into with the present companies. That agreement secures to the four cable companies the exclusive right to have all land messages delivered to them by one of them, it matters not which of course, when the profits and receipts are put into one pool, and shared in different proportions amongst the companies. We have a combination of the four companies which has secured, as I said before, as far as an agreement can secure it, a monopoly of the land traffic of America. That being so, the proportion in which the traffic is to be divided you will see in the circular which has been issued to the shareholders, that those proportions have been regulated by our experience of what a cable will take, in competition without reference to any agreement at all. A certain advantage has to some extent been given to our company as being the oldest, and as having the largest amount of cable appliances under our control, and as men of common sense and men of business I think that the arrangement which has been entered into is, on the whole, as advantageous to the joint companies of our previous partners and to ourselves as any agreement that could be made. In fact, it was the only practicable agreement that could be made. The policy which we had previously decided to try, of reducing the tariff and trying to fill all the cables, had, as far as it has gone, been a failure, and we could not see our way to success within the period which we had any right to call upon a meeting to submit to the sacrifice which would be entailed. In those circumstances, and with these few observations, I call upon the solicitor to read the agreement in your hearing.

The heads of the agreement were then read.

The Chairman said: You have heard the agreement read, and the resolution which I have to propose to you, and which is the only resolution which will be put to the meeting, is, "That the agreement now submitted, of date 12th May, 1881, and made between the Anglo-American Company and the Direct United States Cable Company, the Compagnie Française du Télégraphe, of the first part, and the American Telegraph and Cable Company of the second part be, and the same is hereby ratified and confirmed, and the directors be and hereby are authorised to carry it into effect." Before putting it, I may repeat what I have already said that one part of the arrangement connected with this agreement is that we should at once raise the tariff from 1s., at which it has stood, to 2s. a word. That was performed on Monday last, and I have the satisfaction to tell you that the receipts have been exceedingly good during the three days of this week.

The Marquis of Tweeddale seconded the motion.

Mr. Francis Ferns said, before that agreement was put to the numerous and highly respectable company, he wanted to say one thing, and suggest it for consideration. He had been a shareholder for ten years past, and he found that the exertions of those having the control and management of this company had so reduced the value of it that, instead of getting 6 per cent. as they used to do, now they were reduced to the princely position of 1 per cent. Now, why? He had travelled two hundred miles yesterday in order to hear from the mouth of the noble chairman the reason of it, and what the company was about to do. They had originally six cables, now there were only two.

The Chairman: We have three cables in operation, and a fourth under repair.

Mr. Ferns said that he did not care whether he was altogether right or not: but he wanted to ask in the interests of this company why the proposal made in the agreement had not been in the hands of every member and every proprietor (hear, hear). Before they were asked in brief terms to pass resolutions upon the various clauses of the agreement they ought to have had an opportunity to be allowed to consider it, and to come to a conclusion respecting it. The gentleman in front of him told him that he had the agreement. He could only say he had not had one, and he had been a proprietor for ten years. They had no copy of the agreement sent to them. He knew nothing at all about it, and he was surprised when reading a newspaper well versed in such matters to see a notice of the proposed amalgamation. He could not but think that an arrangement with Jay-Gould could not but be most disastrous to the interests of this company. Who was Mr. Jay-Gould? (Hear, hear.) Was he a man in the interests of this company, or one of those specimens of speculation from the other side of the water who preferred their own interest, even if based on the ruin of others? If they accepted Jay-Gould's proposal they ought to think first of the money they had invested, and those who bore their name, and the proceeds they were expecting from that investment; and they were to consider that they had now dwindled down to 1 per cent. What did it mean but winding up the concern ere long, and Mr. Jay-Gould buying the reversion? With the greatest possible respect to the board, one gentleman of which he knew intimately, he said that the interests of the directorate in this matter was very great, while their own interest was diminishing daily, and that if they sanctioned this proposal they would regret it every hour of their life. He had been told on high authority that they had originally six cables, and now had only two. He hoped he had been misled: but he would ask how it was that so potent an undertaking should arrive at such an agreement, and that they should call the shareholders together, who knew nothing at all about it, except a brief epitome given in the notice convening the meeting. Was that fair to the proprietors of a large undertaking of this sort? Was it suppressed from motives of economy? Economy had not been studied by this board. Let them trace it for years back and find it if they could; extravagant if they liked, and those who were in the extravagance well paid. He was satisfied that when they considered the position they would place themselves in by sanctioning such an agreement as this, hurriedly drawn up, with the shareholders ignorant of it, they would not arrive at a satisfactory conclusion with regard to its confirmation. He might be told that some of these remarks would get into the newspapers, and indeed he had been told so. But what of it? They were as sentries on the watch for their own interests, and they were bound to protect them. And was not this the mode to do it? It was for their interest to see that the agreement was properly drawn and fully carried into effect. Until that was so he submitted that they should not consent to that agreement. They ought to have it at their own homes for consideration. And then they could arrive at a reasonable conclusion as to whether it benefited Jay-Gould on the other side of the Atlantic, or whether it would operate to their own interests. He might be swamped on the one hand, or he might have suggested something worthy of consideration; but whether or not, he submitted that he was speaking in their interests. He would advise them to take advice and speak their mind.

Mr. Jackson said he supposed that the vast majority of the shareholders of this company would be able to form their own estimate of the value of this agreement, knowing as they did the disastrous consequences of the competition threatened. He thought there could not be two doubts on the question of their procedure. They must trust to the body of their directors in negotiating an arrangement of this kind. The gentleman who had just spoken absolutely did not know how many cables were at work. He said only two. He suggested, further, that four-fifths of the capital of the company should be written off, and simply for the fact that for the last nine years the Anglo-American Company had only paid 4¼ per cent. What should be said of a man who would recommend with reference to a railway that because it had paid only 4 per cent. for years, therefore four-fifths of the capital should be written off? He thought they ought to trust in the judgment and experience of the directors, but perhaps without absolute confidence, and he said that without the slightest desire to depreciate the intelligence, or ability, or skill of the board. He said without absolute confidence for this reason. The history of all these arrangements had been one rather disappointing to the shareholders. They had not had a very adequate return on their

capital, because 4½ per cent. was hardly adequate under the circumstances if any one considered the inevitable and great risks in such companies as this. Judging by the history of the past, they had seen their dividend dwindle from a very satisfactory one before these fusions were brought about, till they gradually came down last year to 3½ per cent., and under the 1s. tariff, which was about to be altered, the result had been 1 per cent. per annum. Nevertheless, they must make the best of the situation, and he thought the explanation of the noble chairman would satisfy the shareholders that under the circumstances they could not do better than make this agreement. There had been a good deal of consolidation about this company. Two companies had been taken over at 30 per cent., two other cables were also absorbed at the market value, and now they were doing a large business and paying a large dividend and their stock was at a very large premium. One consideration ought to weigh in estimating the value of their property. In many of the railway companies in this country, for instance, dividends were habitually paid out of capital; but not one dividend had been so paid in the history of their company. That fact ought to explain the strong position which they occupied that day. He said "strong position"—because it was a strong position that they should be able to negotiate such an arrangement as they had before them. He thought these observations were called for by the misrepresenting statements which had been made to them.

Mr. Seeley asked whether this arrangement which it was proposed to carry out with the Jay-Gould Company was similar to the one proposed some twelve months ago. He understood that it was stated at last meeting that they had been endeavouring to make arrangements with him. He would like to know whether the present agreement was on the same basis. Of course they had a very low tariff at that time, and there had been a very, very small dividend, which would, doubtless, affect the negotiations. About nine years past they had received 4¼ per cent., but if they took a shorter period the dividend would be considerably smaller; and after every fusion they had had, so far as he could recollect, their dividend had fallen. It was the case when the Anglo and the French Company amalgamated. In the present case they were to receive 55 per cent. of the profits, and when another cable was put down they were to receive 48. If that was to go on, if these arrangements or fusions were to be allowed, he could not but think that the same results would follow. They were simply inviting competition to cable manufacturers (hear, hear), and speculators who traded upon the traffic that this company had formed to itself. They knew pretty well that if business men allowed competitors to come and trade upon their field of enterprise, if they did not endeavour to exert all their energies in opposing them—and he might say crushing them, if they unfairly trespassed on their rights—if they did not stand up manfully to endeavour to keep their position, they would ultimately be driven to that wall instead of their opponent. It was for them to consider before they passed the resolution whether they were to truckle to that unfair enemy who would come and attack them again and again as sure as the sun would set that night. He should like his question to be answered, as he thought that it was a very pertinent one. They ought to know whether they would be any gainers by waiting the nine months.

Mr. Newton asked why they had not made the tariff 3s. per word. The history of this company had been one of persistent attack from one manufacturing company. Mr. Jay-Gould had simply been a tool though he would probably make a satisfactory use of his position. If the public wanted 8 or 9 or 10 cables they should be made to pay for them; and if they were to have these repeated amalgamations, the public must pay for the luxury. He did not think 2s. a word was enough; others were getting 4s. or 5s. per word, and he thought they should have at the least 3s. He should also ask how it was that the press, which persistently misrepresented and attacked the company, had facilities as to messages which were not given to the mercantile community. The press could send messages at 6d. per word, and he thought they were no more entitled to send messages at 6d. than to send them for nothing at all. They were the cause of the company's persistent troubles.

Mr. Leach inquired whether there was anything in the arrangement which would prevent any others from establishing a new cable. (Laughter).

The Chairman: I will endeavour as briefly as I can to answer the questions put to me, and I will answer the last first, because it admits of a very easy answer indeed. I wish it were in our power to put into any agreement a prohibition of competing cables, and the same principle which supplies the answer to that question will supply an answer to a great many of the objections raised by different speakers to-day. If we could stop the construction of further cables, there would be no need to meet to-day or at any time for your consent to an arrangement with new companies. One gentleman said, "Act a manly part! keep competitors out of your ground!" I should be delighted to do it; nothing would give me greater pleasure; but I confess I cannot arrogate to myself any superior intelligence, but I think I have very good assistants. I confess it is beyond our power to devise any scheme by which such a project could be carried into effect. If we could we would, but as we cannot prevent competition, we must, as I said in my opening remarks, accept the position and make the best of it. That is what we endeavoured to do, and it is all we can do. It is no use professing to be able to do more than is in the range of the possible. The first gentleman who spoke has been so ably answered by my old friend Mr. Jackson, that I scarcely feel called upon to say anything more about his remarks. I will just make, however, one or two additional observations. He opened his speech by saying that the effect of the management of this concern was to injure the shareholders. It is no uncommon fallacy for people to say that because an event happens after a certain thing, that therefore the certain thing was the cause of what happens. Undoubtedly you were receiving a much larger dividend before these fusions took place than you have been receiving since, but I beg leave to say that the fusions were not the cause of the reductions; the cause was the competition which was brought into operation by the construction of new cables, and which the fusions were made in order to qualify and modify, as far as it was in the nature of things to qualify and modify each competition. Mr. Ferns complained that your dividend had gone down to one per cent. I really think it was scarcely a fair statement. We paid you last quarter an interim dividend undoubtedly at the rate of one per cent. But it is right that you should remember that the policy then adopted was not exclusively or originally the policy of the board. It had been pressed upon us over and over again by the shareholders—the policy of a low scale in order to obtain an increased traffic—and in doing that it was of course a necessary incident of such a step that you should suffer somewhat at first. It is notorious that the reduction of a rate of taxation or anything of that kind very often increases the aggregate receipts; but is it not the case that at first there is a period during which you suffer from the reduction of the rate, though in the long run you may obtain a larger aggregate. That was the reason of the small interim dividend which was paid last time. I do not want to act the part of a prophet or forecast great results, but my belief is that instead of one per cent. the dividend will go up very considerably above that, and probably reach its normal condition. Mr. Ferns further complained that no notice of this agreement was sent to the shareholders. The effect of the agreement was stated in the circular which was sent.

Mr. Ferns said that it was the agreement itself that he meant. As one who knew something of agreements, he repeated that they ought to have had it in their hands.

The Chairman: All I can say is this. In managing a concern of this kind your directors endeavour to conform to the precedent which always exists in all companies of the same description. We have never had any secrets with the shareholders, and have always told you at our meetings and in public exactly how things stand with us. I think, however, you would rather complain of the expense if we printed this long agreement and sent it to all the shareholders by post, three-tenths of whom, without any disparagement to your intelligence and ability, would not be able to understand one word of it. (Laughter.) I speak of laymen before a legal agreement couched in legal form. We give you what is much better than that—an epitome of the agreement containing the main provisions of it in popular language, so that you can understand it without going to a lawyer to explain it. That is what we have done, and I conceive that it is the established and usual course. He said, further, that this agreement was hurriedly drawn up. As your chairman I know something of what has been done in the way of drawing it up, and I know that our board and our solicitors—and I see in the room the representatives of the other companies, who can corroborate what I say—that they have worked hard since March 10th at the document which is now said to have been hurriedly drawn up. If two months are not sufficient to exercise ingenuity over an agreement, the words "hurriedly drawn up" are not misapplied, but only on that supposition. Mr. Ferns recommended the meeting to reject this agreement, and I would like to know, because he did not give any indication in his speech, what alternative he proposes if it is rejected?

Mr. Ferns: I wanted this agreement placed in the hands of each proprietor, and this meeting should be adjourned.

The Chairman: Oh! I do not think that a very provident course, though undoubtedly it is a tangible proposition; but that is not what he said when he was on his legs before. He simply advised the meeting to reject the agreement, and of course I can only deal with what he says. He suggested no alternative, and I believe that no better one could be suggested. It is the best arrangement that could be made. Mr. Newton asked two other questions: Why did we not raise the tariff to 3s.? He stated at the same time that if the public wanted to have the luxury of a large number of cables they ought to be compelled to pay for them, in which observation I entirely concur. Our simple reason for putting the rate at 2s. per word was, that after considerable experience of different rates of tariff we found that the 2s. tariff was that which brought us in most money. Another word with regard to press messages. These are nominally sent at a lower rate; but there are two reasons that will explain that to any gentleman in the room. You are all aware that from the difference in time between this country and New York the business part of our work is to be transacted in a very few hours—six or eight at the most. During the remainder of the twenty-four the cables are comparatively idle, and therefore whatever we can get at that time is pure gain. Now the press messages, as a rule, are sent at these hours, so that whatever are sent are a gain to the company. But there is also another reason why the press messages are sent at a lower rate. By means of a code business men can get a great deal of matter across the Atlantic in a very small compass. The press messages are always sent in open words, so that they almost pay as much, though at a smaller rate, as the business messages. Mr. Seeley asked another question with regard to negotiations we had entered into, whether we could have got the same terms as we have got now in the spring of last year. You will see by the circular that we have given to the American Company under this arrangement 12·5 per cent. of the traffic as long as our cable is working. The proposal made to us at that time was that we should give them 14 per cent. on the same conditions. So it is clear that by waiting a little we have considerably reduced the proportion. I will now put the resolution.

The resolution was then put to the meeting and carried, with three dissentients.

Two shareholders asked simultaneously whether the receipts of the company could be published monthly as heretofore.

The Chairman said that one of the inconveniences of such arrangements as they had entered into was that they could not manage their business without the assent of those with whom they had made the agreement, and he was afraid he could not answer that question without consulting the co-signatories.

The proceedings then terminated.

DIRECT UNITED STATES CABLE COMPANY (LIMITED).

AN extraordinary general meeting of the above company was held on Thursday, the 25th ult., to consider the joint purse agreement which had been drawn up between the four companies referred to in the preceding report, viz., the Anglo-American Telegraph Company, the Compagnie Française, the Direct United States Cable Company, and the American Telegraph and Cable Company.

Mr. John Pender, M.P., chairman of the company, presided. The secretary having read the circular convening the meeting, the chairman said: Gentlemen, before putting the resolution which we have invited you together to approve of to-day, I shall make a few remarks so as to give you a fair idea of the present position of things, and our reasons for entering into this agreement. We have called you together to-day for a special purpose. This is the third time that I have had the honour of addressing you at an extraordinary meeting. The first was to ask your approval of the joint purse arrangement with the Anglo-American Company that has been carried on for some time, and I believe with very fair success. The second was to ask your approval of an arrangement of a similar nature with the French Company. The third, and probably the most important of all, is to approve the joint purse agreement just completed with the American Telegraph and Cable Company, and also an arrangement with the Western Union Company—a company to which I alluded at our last formal meeting. At that meeting I gave you a very considerable amount of information, not only on the subject of the shilling tariff, but also as to the formidable opposition which you were about to meet, and also indicated that a great deal of money might be required to maintain our contracts with the various land line systems in America with which we had traffic arrangements, viz., the Atlantic and Pacific and the Franklin Companies in the United States, and the Dominion Telegraph in Canada. These having been brought under the control of the Western Union made the difficulty still more complicated, and a still more powerful combination to contend with. We foresaw in this a very formidable competition which meant lower dividends and vastly increased expenses, and I will tell you that expensive as law is in this country it is much more expensive on the other side of the Atlantic. Therefore it became a serious question whether it would not be desirable to come to some arrangement, if one of an honourable nature could be come to, beneficial alike to this company and to all parties concerned. These are the reasons which induced us to go into these negotiations, because we know perfectly well that competition means lower, and in many instances no dividend at all. The dividends we have been paying have not been by any means excessive. It was our desire to maintain for this company, as we have from the time that we became directors of it, a uniform dividend. This we have done, of 5 per cent., and this I hope, through these arrangements, we shall be able to continue to pay to our shareholders. However, our first attempts in the direction of compromise failed. There was an evident desire, as we thought, on the part of the American Cable Company and of Mr. Jay-Gould who created it, that some understanding should be arrived at. I have always held that arrangements between Telegraph Companies are desirable where they can be considered mutually beneficial. Negotiations were re-opened, and the result is the agreement now submitted to you, which I hope you will consider satisfactory. We therefore ask you to sanction it, but I have thought it right in the first place to give you a slight sketch of the companies with which these working arrangements have been entered into. The Western Union has the control of all the vast telegraphic system of North America, including Canada, representing a capital of upwards of £10,000,000. To form an idea of the enormous extent of the system I may mention that the length of wire under its control is 327,171 miles. You will better realise this when I state that the total length of wire of the British Post-office system is 116,680 miles, and I may also mention that we have the assurance that if direct land wires are required between the seaboard and the important cities of America, so as to give the greatest possible facilities for submarine telegraphy, they will be constructed by that company. Such is our confidence in the power of that company that we have made it part of the arrangement that they should take over during our pleasure our offices in New York, and work our land lines, and I may say that this bargain will, I believe, benefit our exchequer to the extent of some thousands a year. Of course, if any competition should arise which would necessitate our taking possession of our offices again, we are at perfect liberty to do so, and we have reserved to ourselves the right to do so. Having such a powerful connection on the other side to protect our interests there, we do not anticipate any competition which will require such a change. You will see from these arrangements that we have secured a very powerful ally in America, so that we shall be able to lay down cables, and to be indeed in the position of possessing the whole control of the land system of America and Canada. But no doubt we shall hear of such competition again. Indeed, only a day or two ago I heard of another company which was to come out with a ninepenny tariff. Now, we can speak with some confidence on the question of tariffs. We have now given the 1s. rate a year's trial, and if we had gone into another year we should not be able to declare a dividend, moderate as it is, which we have been doing since the company was reconstructed. We have also the experience of a French company, who are under the control to a great extent of the telegraph department of France. Before that Company changed the tariff from 1s. to the present rate of 2s. they were obliged to satisfy the Minister of Telegraphs in France that the 1s. rate was unremunerative, and I believe that the advice of the Government accountant who was sent to inspect the accounts was that they should charge 3s. instead of 2s. if the shareholders were to receive such a return as they were entitled to expect. Mr. Jay-Gould also discovered that 1s. would not give a fair amount of remuneration on a property like this. As evidence of this, you may remember that while we were working at 1s. he opened his cable at 1s. 6d., and finally intimated to us that even if no arrangement were made the 2s. tariff would have to be adopted. These arrangements have led us to resume the 2s. I may mention as a justification that during the whole time the 2s. were in force we never had any complaint from those who used the cables. And I find now that when the tariff has been again advanced that a similar feeling of satisfaction has been expressed; and for this simple reason—that 2s. in large commercial operations is but a very small percentage on the operation itself, and consequently rarely influences in any way the number of telegrams forwarded. Speed and accuracy is the important element, and the difference between the 1s. and the 2s. is so small as not to influence their going in largely for the former in preference to the latter. We have found by experience that the 1s. tariff would never give such an amount of traffic as would have secured to us the very moderate dividend which we have been hitherto able to pay. We should have continued it for a very long period. Strange as it may seem, our experience of 1s. is that lately our traffic has been rather decreasing than increasing upon it. That is a very remarkable fact, but still it is a fact which it is well you should know. The 1s. tariff has not caused the amount of traffic in the way naturally expected. And I may say further, for I do believe in a very considerable extension in the use of the telegraph system, had we continued at the 1s. until we got as much money out of the 1s. as we now get out of the 2s., it would have cost the company something like two millions sterling to get to that point. This is a very important fact, that the public should understand as well as the shareholders; and I mention it as showing that we are carefully watching your interests, and endeavouring as far as we possibly can to maintain not only an efficient system of telegraphy, but at the same time pay a moderate dividend to our shareholders. There will be nothing so dangerous as to render telegraphs unremunerative. I do not exaggerate when I say that three-fourths, and probably nine-tenths, of the trade of the world is carried on by the aid of submarine and land telegraphs. The commercial world could not now live without it. The political world would be in a state of tension, and commercial enterprise would suffer greatly if the cables were interrupted or the companies were placed in the position of having worn-out cables and no reserve to replace them; and therefore, in the interest of the public, Government, and the community—I might say of social life, too—the submarine system should be maintained, so as to give a fair dividend. I believe now that this combination just completed makes it the most powerful of its kind in the world. On the other side of the Atlantic, with all their natural enterprise, we are earnestly interested in giving the first consideration to having a thoroughly complete and efficient service. I may, I think, without any breach of confidence, read a telegram received, amongst others, from Mr. Jay-Gould, which runs as follows:—"I have received message advice of the execution of the cable contracts. I am greatly pleased that it is finally settled, and hope and trust they will prove profitable to all interests, and this result can beyond doubt be achieved if we only pull together strongly in the lines you indicate of improving and perfecting our international system of telegraph business." When I have said that this is perhaps the most powerful combination that was ever entered into, some people might call it by an ugly name and say it is a great monopoly; but I hold that there is nothing of the monopoly character in it. You cannot call any system of combination to give an efficient service to the public, and only take from the public in return a 5 per cent. dividend, a monopoly. I therefore hold that the public, whose interests ought to be protected as well as the shareholders, are large benefactors at the present moment by the combination now formed. I have, therefore, shown you that your interests in all these negotiations have been carefully considered. I also hope that these new arrangements will enable us to maintain at least the 5 per cent. which we have paid you during the last three or four years, and enable us to put past such a reserve fund as will enable us to replace our cable. I have said that I believe three-fourths, if not nine-tenths, of the trade of the world is carried on by the aid of submarine telegraphy. As a proof of this I have been watching the negotiations in respect to the present agreement and arrangement, all of which have been carried on by cable. And most important negotiations you will admit they are, representing or involving as they do a capital of over ten millions sterling. The speed, the accuracy, of the transmission has astonished even myself, who have been so long connected with submarine telegraphy, and I was amazed that human thought should be so rapidly transmitted and re-transmitted, so that the lawyers sitting here on one day had in the morning an answer to the points which they dealt with the previous day. All this leads one to conclude that telegraphy has now got such a hold on the various interests of the world that it is simply impossible to do without it, and its progress is as certain as that the sun appears in heaven. As an interesting fact of the speed at which we can now annihilate time and space I will give you this interesting fact in connection with our cable, as showing the celerity with which events can be communicated across the Atlantic. I may mention that the name of the winner of the Derby was transmitted to our office in New York from London in 35 seconds from the conclusion of the race. I have given you a little information on the subject of telegraphy, and I think we have been attending to your interests in making this arrangement. The control we have got of the whole land system is such that, if a new company came forward, as a gentleman stated to me to-day, "I should like to sell its stock at 50 per cent. discount the day it comes out." As to the hopes of its being a success, at all events without an enormous sacrifice in time and money, they would have to wait until telegraphy increased so as to give a return upon the amount of the fresh capital. I think the only view to take of such a scheme would be that it was a folly such as I hope does not exist in the minds of men at the present moment. With these remarks I shall ask the solicitor to read to you the heads of the agreement which we have entered into with the American Telegraph Company.

The heads of agreement nearly identical in terms with those presented at the meeting of the Anglo-American Telegraph Company were then read, and the Chairman said: I shall now put the resolution, but first if any gentleman has any remarks to make upon the heads of agreement, or upon the remarks just made, I shall be glad to hear them. The resolution is, "Resolved that the agreement now submitted as made between the Anglo-American Telegraph Company, the Direct United States Cable Company, and the Compagnie Française in the first part, and the American Telegraph and Cable Company in the second part, be, and the same is hereby ratified and confirmed, and the directors be authorised to carry the same into effect."

Mr. William Ford seconded the resolution.

Mr. Jackson congratulated the meeting on their prospective policy, which he was sure they must appreciate as bringing them into the most powerful combination yet attempted by telegraphic companies. It had been said that the policy of the Anglo was to secure the shareholders a fair dividend with the lowest possible tariff. That is the principle on which the united companies should act, so as to anticipate or rather prevent competition, which they would no doubt have very much suffered from in the establishment of these new cables. He wished that it could be publicly stated that the policy of the company would be to reduce the tariff, after such a dividend as they considered fair and moderate, so as not to take advantage of the possible consequences of this organisation to work as a monopoly. It was not presumable that even a fair dividend on the Anglo-American capital would be obtained at the 2s. tariff in any moderate period,—far less a liberal dividend,—but he thought the announcement of such a policy to be content with a moderate dividend and a sufficient renewal reserve would satisfy them, and prepare them to share with their customers any further increment of dividend. He was quite sure that such a policy would be the only one under the circumstances to stop that extraordinary speculation or enterprise which was ready to float Atlantic cable companies with the certainty of a 50 per cent. reduction. Notwithstanding that reduction, national susceptibilities had to be satisfied. If the French nation were not satisfied to have messages carried over a friendly line, other countries would take the same view. And if these great countries, which represented the bulk of the trade, were now in possession of their own lines the ground for competition was very much cut away. The Anglo-American Atlantic cable paid nine per cent. in 1870, and in 1872 ten per cent. with an additional bonus; but it then stood as a monopoly, there was no competing line. He hoped there would be no attempt on the part of their directors to imitate such a state of things. He hoped they would hear some announcement that it was not only the intention but the resolute determination of this company to be satisfied with the creation of a sufficient reserve and a moderate dividend. That would do much, as far as he could judge, to prevent the competition that was so often decried.

The Chairman: Gentlemen, when we gave the 1s. rate we did it with an honest desire to benefit the large telegraphical public, and to satisfy ourselves as to whether that would be a remunerative rate for the shareholders. As I told you in the few remarks I addressed to you, we found that the 1s. rate not only did not give us a return, but that, looking to the progress made, it would have taken five years before we got the same return as the 2s. Consequently we would require two millions to be spent to get the return at 1s. which we now are getting at 2s., and even then it would be difficult to say whether at the end of the five years we should get it or not. We are as anxious to have low rates and large traffic as any. We have tried very high rates. We had a considerable period at 4s. and at 3s.; we went down to 2s., 1s., and at one time to 6d., but watching closely the rate that is not considered a tax by the telegraphing public, we consider that 2s. is the best permanent rate, and the one that best satisfies the public. As to France and America, France determined to have their cable—and they have got it—to America. What has astonished me is that the Americans were so long in having a cable of their own. There is an enormous traffic done between this country and America, and I often wondered that of all their capital and enterprise they did not get a cable of their own. They left us to do it, and we have been the pioneers and leaders. They chose to come in, and I don't see any harm in letting them have a fair proportion, and the proportion they now receive is not the full proportion of two cables, but one which we may find another year hence to be strengthening our own dividend. I am quite hopeful with the tariff which we have established that we shall get such a return as will maintain a five per cent. dividend, with the reserve gradually growing. Just one other word. The Germans had some idea in the same direction. There is telegraphic communication between Berlin and New York, so that they now have their own cable without coming through London. Therefore the *amour propre* of each country is met, and I am hopeful that we shall have a little peace in the Atlantic for some little time to come. What we have done to-day we have done in the belief that it was better to enter into that combination than throw away in competition a very large amount of money, and probably disgust our shareholders at the same time. I will now put the resolution.

The resolution was then put to the meeting, and carried unanimously.

The Chairman: I am obliged for your attendance here to-day, and I believe I may congratulate you on the completion of this arrangement for the interests of our concern.

Mr. Jackson, in moving a vote of thanks to the Chairman, said their prospects were brighter than they had been for some time past.

Mr. J. Vernon Bird seconded the motion, which was carried unanimously.

The Chairman, in responding, said that they might rest assured that they would do all in their power for the interests of the company. They had watched them carefully, and it had been a very anxious time during the negotiations, which had extended over nearly six months, and every point of which had been fought most carefully. He begged to thank them for the vote of thanks. The proceedings then terminated.

FALMOUTH-BILBAO CABLE.—The Direct Spanish Telegraph Company's cable between Falmouth and Bilbao, which was interrupted on April 30th, was restored on the 19th inst., by Mr. A. Le Neve Foster in the ss. *H. C. Œrsted*. The repairs were very rapidly effected under difficult circumstances, there being a heavy sea or swell on all the time. At times, while the work was going on, the ship rolled so heavily that it was thought the operations would have to be suspended. The *H. C. Œrsted* arrived at the India-rubber Company's Works at Silvertown on Tuesday afternoon, and after discharging cable and stores she returns to her headquarters at Copenhagen.

DIRECT SPANISH TELEGRAPH COMPANY.—The restoration of communication with Spain *via* Bilbao, by the company's cable, was notified at the end of last week.

BRAZILIAN SUBMARINE TELEGRAPH COMPANY.—Under date May 30th, the secretary of this company informs us that the cable between St. Vincent and Pernambuco is repaired; communication is therefore restored with South America.

WESTERN AND BRAZILIAN TELEGRAPH COMPANY.—This company notify the repair of the Bahia-Rio de Janeiro section of their cables, and that with this repair their whole system between Para and Monte Video is now in perfect working order.

GREAT NORTHERN TELEGRAPH COMPANY.—This Company's Amoy-Shanghai Cable is interrupted. Until repaired, this Company's route is the only telegraphic route to Shanghai and all stations in China North of Shanghai besides Japan, while telegrams for Amoy, Hong Kong and Manila, cannot be accepted until further notice.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. May 31.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	22½ - 23½	23¼ ¼ ¼ 3.¼
	10	Do. Do.	10	50 - 55	53¼ 3.1¼
150,000	1	Electric Light and Power Generator Co.	1	1 - 1¼	1¼
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	54 - 55	
2,441,800*l.*	Stk.	Do. Preferred (Def'd. receiving no div. until)	100	86 - 87	86¾
2,441,800*l.*	Stk.	Do. Deferred (6 p. c. has been paid to Pref.)	100	24 - 25	24¼
130,000	10	Brazilian Submarine, Limited	10	11¼ - 11½	11¾ ½
16,000	10	Cuba, Limited	10	8½ - 9	
6,000	10	Do. 10 per cent. Preference	10	15½ - 16½	
13,000	10	Direct Spanish, Limited	9	6 - 6½	
6,000	10	Do. 10 per cent. Preference	10	15½ 16½	16
65,000	20	Direct United States Cable, Limited, 1877	20	12¼ - 12½	12¼
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	101 -104	
380,000	10	Eastern, Limited	10	10½ - 10¾	
70,000	10	Do. 6 per cent. Preference	10	12¾ - 13¼	13
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	99 -102	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,030*l.*	100	Do. 5 do. do. Aug. 1899	100	102 -107	
199,750	10	Eastern Extension, Australasia & China, Limited	10	11½ - 11¾	11⅝
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	103	106 -110	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1909	100	103 -106	
140,000	100	Do. do. registered, repayable 1909	100	103 -106	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	101 -104	
254,300*l.*	100	(Eastern and South African Limited 5 per cent. (Mort. Deb. Registered redeemable 1 Jan. 1900)	100	102 -105	
345,700*l.*	100	Do. do. do. To Bearer	100	102 -105	
22,050	10	German Union Telegraph and Trust, Limited	10	9½ - 10	
163,390	10	Globe Telegraph and Trust, Limited	10	6¼ - 6⅝	6⅜ ⅜
163,209	10	Do. 6 per cent. Preference	10	12½ - 12⅝	12⅜ ⅜
125,000	10	Great Northern	10	12¾ - 13¼	
100,000*l.*	100	Do. 5 per cent. Debentures	100	102 -105	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	25½ - 26½	
100,000	100	Do. 6 per cent. Debentures, 1886	100	101 -105	
17,000	25	Indo-European, Limited	25	28 - 29	
38,148	10	London Platino-Brazilian, Limited	10	4¼ - 4⅝	xd.
12,060	10	Mediterranean Extension, Limited	10	2 - 2⅜	
8,200	10	Do. 8 per cent. Preference	10	8½ - 9	8⅞
9,000	8	Reuter's, Limited	8	12¾ - 13¼	
280,000	Stk.	Submarine	100	265 -275	
58,225	1	Do. Scrip	1	2⅜ - 2⅝	2 7/16
4,200	Cert.	Submarine Cables Trust	100	104 -107	103½
37,350	12	Telegraph Construction and Maintenance	12	29½ - 30½	
150,000	100	Do. 6 per cent. Bonds, 1884	100	102 -105	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1⅛ - 1⅜	
30,000	10	West Coast of America, Limited	10	5½ - 5¾	
150,000	100	Do. 8 per cent. Debentures	..	.. ..	
62,910	20	Western and Brazilian, Limited	20	7 - 7¼	
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	107 -112	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80. red. Feb., 1910	100	99 -102	
1,500	$1,000	Western Union of U. S. 7 p.c.1 Mort.(Building)Bds.	$1,000	121 -126	124.½
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	102 -105	
88,321	10	West India and Panama, Limited	10	1⅞ - 2	
34,563	10	Do. 6 per cent. 1st Preference	10	8¾ - 9	
4,669	10	Do. 6 do. 2nd do.	10	6¾ - 7¼	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1⅞ - 2⅛	1 15/16
200,000	1	Oriental Telephone Co.	½	⅛ - ¼	1/16
100,000	5	United Telephone Co.	5	14¾ - 15¼	15¼

TRAFFIC RECEIPTS.

The West India and Panama Telegraph Company, Limited. The estimated traffic receipts of this company for the half-month ended the 15th May are £3.237, as compared with £2,766 in the corresponding period of 1881. The January receipts, estimated at £4,856, realised £5,039.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending April 21, 1882, were £1,767, after deducting the "fifth" of the gross receipts payable to the London Platino-Brazilian Telegraph Company.